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UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF ANIMAL INDUSTRY, J. R. MOHLER, *Chief*

SPECIAL REPORT ON DISEASES OF THE HORSE

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For printing and binding in cloth with illustrations, twenty thousand copies of the Special Report on the Diseases of the Horse, the same to be revised and brought to date, of which fifteen thousand shall be for the use of the House of Representatives, and five thousand for the use of the Senate, \$20,000, and including printing and binding in cloth, with illustrations, thirty-five thousand copies of the Special Report on the Diseases of Cattle, the same to be revised and brought to date, of which twenty-six thousand two hundred shall be for the use of the House of Representatives, and eight thousand eight hundred for the use of the Senate, \$30,000.

Foreword

This book supplies general information to horse owners concerning diseases and ailments of their animals. Aside from the treatment of the less serious conditions and the administration of first aid in emergencies, it is not advisable for the stock owner to give drugs or attempt to perform surgical treatment. Such procedures, except when undertaken by trained practitioners, involve serious risk to the health or even life of animals treated; and the authors of this book disclaim responsibility for results in such cases. However, stockmen can do much along preventive lines to protect the health of their animals, especially by their proper feeding, care, management, and sanitation. In general the discussion of diseases of horses applies also to those of other equine stock such as mules, asses, and burros.

In administering first aid or engaging in other treatment, the stock owner should seek to prevent unnecessary suffering. Considerate treatment of livestock is desirable both from a humane standpoint and because greater returns may be expected from animals that receive good care.

In most parts of the United States the services of a competent veterinarian are available, and it is advisable to call such a practitioner when medical or surgical attention is needed. In infectious diseases, the stockman should call a veterinarian at the first indication of symptoms that are of suspicious character to avoid unnecessary spread of infection on the farm or to other farms in the neighborhood. A careful study of the discussion concerning symptoms of such diseases will aid the owner in recognizing them when they first make their appearance.

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Examination of a Sick Horse

By LEONARD PEARSON, B. S., V. M. D.

[Revised by HUBERT BUNYEA, A. B., D. V. M.]

In the examination of a sick horse it is important to have a method or system. If a definite plan of examination is followed one may feel reasonably sure, when the examination is finished, that no important point has been overlooked and that the examiner is able to make as accurate a diagnosis as possible. Of course, an experienced eye can see, and a trained hand can feel, slight alterations or variations from the normal that are not perceptible to the unskilled observer. A thorough knowledge of the conditions that exist in health is of the highest importance, because it is only by a knowledge of what is right that one can surely detect a wrong condition. A knowledge of anatomy, or of the structure of the body, and of physiology, or the functions and activities of the body, is the basis for making an accurate diagnosis. Animals of different types react differently to the same disease or pathological process. For example the sensitive and highly organized thoroughbred resists cerebral depression more than does the lymphatic draft horse. Hence a degree of fever that does not produce marked dullness in a thoroughbred may cause great dejection in a coarsely bred, heavy draft horse. These and similar facts are of vast importance in the diagnosis of disease and in the recognition of its significance.

The order of examination, as given hereafter, is comparatively easy to apply and sufficiently thorough for the purpose of the readers of this work, and is recommended by several writers.

HISTORY

It is important to know, first of all, something of the origin and development of the disease; therefore the cause should be looked for. The cause of a disease is important, not only in connection with diagnosis but also with treatment. The character of feed that the horse has had, the use to which the animal has been put, and the kind of care received should be all closely inquired into. It may be found by this investigation that the horse has been fed damaged feed, such as spoiled brewers' grains or moldy silage, and this may be sufficient

to explain profound depression and weakness. If it is learned that the horse was kept in the stable without exercise for several days and on full rations, and that the animal became suddenly lame in its back and hind legs and finally fell to the ground from what appeared to be partial paralysis, this knowledge, in connection with a few evident symptoms, will be enough to establish a diagnosis of azoturia (excess of nitrogen in the urine). If it is learned that the horse has been recently shipped or has been through a dealer's stable, this knowledge is significant in connection with the cause of a possible febrile disease, which, under these conditions, may prove to be influenza, or edematous pneumonia.

It is also important to know whether the particular horse under examination is the only one in the stable, or on the premises, that is similarly afflicted. If it is found that several horses are afflicted in much the same way, the examiner has evidence of a common cause of disease that may prove to be of an infectious nature.

Another important item in connection with the history of the case relates to the treatment that the horse may have had before it is examined. Medicine given in excessive quantities sometimes produces symptoms resembling those of disease, therefore, it is important that the examiner be fully informed as to any medication that has been employed.

ATTITUDE AND GENERAL CONDITION

Before the special examination is begun, attention should be paid to the attitude and general condition of the animal. Sometimes horses assume positions that are characteristic of a certain disease. For example, in tetanus (lockjaw) the muscles of the face, neck, shoulders, and jaw are stiff and rigid. This condition produces a peculiar attitude that once seen is subsequently recognized as rather characteristic of the disease. A horse with tetanus stands with its muscles tense and its legs in a somewhat bracing position, as though it were prepared to repel a shock. The neck is stiff and hard, the head is slightly extended upon it, the face is drawn, and the nostrils are dilated. The tail is usually held up a little, and when pressed down against the thighs it springs back to its previous position. In inflammation of the throat, as in pharyngolaryngitis, the head is extended upon the neck, and the angle between the jaw and the lower border of the neck is opened as far as possible to relieve the pressure that otherwise would fall on the throat. In dumminess, or immobility, the hanging position of the head and the stupid expression are rather characteristic. In pleurisy, peritonitis, and some other painful diseases of the internal organs, the rigid position of the body denotes an effort of the animal to avoid pressure upon and to protect the inflamed sensitive region.

The horse may be down in the stall and unable to rise. This condition may result from paraplegia (paralysis), from azoturia, encephalitis, tetanus, or painful conditions of the bones or feet, such as osteoporosis or founder. Lying down at unusual times or in unusual positions may indicate disease. The first symptom of colic may be a desire on the part of the horse to lie down at an unusual or inappropriate time or place. Sometimes disinclination to lie down is an indication of disease. When there is difficulty in breathing, the horse knows that it can manage itself better on its feet than on its breast or side. Therefore, in nearly all serious diseases of the respiratory tract the animal stands persistently, day and night, until recovery has commenced and breathing is easier, or until it falls from sheer exhaustion. If there is stiffness and soreness of the muscles, as in rheumatism, inflammation of the muscles from overwork, or of the bones in osteoporosis, or of the feet in founder, or if the muscles are stiff and beyond control, as in tetanus, a standing position is maintained.

Abnormal attitudes are assumed in painful diseases of the digestive organs (colic). A horse with colic may sit on its haunches, like a dog, or may stand on its hind feet and rest on its knees in front, or may endeavor to balance itself on its back, with all four feet in the air. These positions are assumed because they give relief from pain by lessening pressure or tension upon the sensitive structures.

Under the general condition of the animal it is necessary to observe the state of nutrition, the conformation, so far as it may indicate the constitution, and the temperament. By observing the state of nutrition one may be able to determine to a certain extent the effect that the disease has already had on the animal and to estimate the amount of strength that is available for the repair of the diseased tissues. A good condition of nutrition is shown by the rotundity of the body, the pliability and softness of the skin, and the tone of the hair. If the subcutaneous fat has disappeared and the muscles are wasted, allowing the bony prominences to stand out, if the skin is tight and inelastic and the coat dry and harsh, there is a low state of nutrition. This may have resulted from a severe and long-continued disease or from lack of proper feed and care. When an animal is emaciated, there is first a loss of fat and later the muscles shrink. By observing the amount of shrinkage in the muscles one has some indication as to the duration of the unfavorable conditions under which the animal has lived.

By constitution is meant the innate ability of the animal to withstand disease or unfavorable conditions of life. The constitution depends largely on the conformation. The type of construction that usually accompanies the best constitution is deep, broad chest,

allowing plenty of room for the lungs and heart, indicating that these vital organs are well developed; capacious abdomen, allowing sufficient space for well-developed organs of digestion; short loins—that is, the space should be short between the last rib and the point of the hip; well-molded head and neck, without superfluous or useless tissue—this gives a clear-cut throat. The ears, eyes, and face should have an expression of alertness and good breeding. The muscular development should be good; the shoulders, forearms, croup, and thighs must have the appearance of strength. The withers are sharp, which means that they are not loaded with useless, superfluous tissue; the legs are straight and their axes are parallel; the knees and hocks are low, which means that the forearms and thighs are long and the cannons relatively short. The cannons are broad from in front to behind and relatively thin from side to side. This means that the bony and tendinous structures of the legs are well developed and well placed. The hoofs are compact, tense, firm structures, and their soles are concave and the frogs large. Such a horse is likely to have a good constitution and to be able to resist hard work, fatigue, and disease to a maximum degree. On the other hand, a poor constitution is indicated by a shallow, narrow chest, small bones, long loins, coarse neck and head, with thick throat, small, bony, and muscular development, short thighs and forearms, small joints, long, round cannons, and hoofs of open texture with flat soles.

The temperament is indicated by the manner in which the horse responds to external stimuli. When the horse is spoken to, or when he sees or feels anything that stimulates or gives alarm, if he responds actively, quickly, and intelligently, he is said to be of lively, or nervous, temperament. On the other hand, if he responds in a slow, sluggish manner, he is said to have a sluggish, or lymphatic, temperament. The temperament is indicated by the gait, by the expression of the face, and by the carriage of the head and ears. The nature of the temperament should be taken into consideration in an endeavor to ascertain the severity of a given case of illness, because the general expression of an animal in disease as well as in health depends to a large extent on the temperament.

SKIN AND VISIBLE MUCOUS MEMBRANES

The condition of the skin is a fair index to the condition of the animal. The effect of disease and emaciation on the pliability of the skin has been referred to previously. There is no part of the body that loses its elasticity and tone as a result of disease sooner than the skin. The practical stockman can gain a great deal of information as to the condition of an animal merely by grasping the coat and

looking at and feeling the skin. Similarly, the condition of the animal is shown to a certain extent by the appearance of the mucous membranes. For example, when the horse is anemic as a result of disease or of inappropriate feed the mucous membranes become pale. This change in the mucous membranes can be seen most readily in the linings of the eyelids and of the nostril. For convenience of examination the eyelids can readily be everted. Paleness indicates weak circulation or poor blood. Increased redness occurs physiologically in painful conditions, excitement, and following severe exertion. Under such conditions the increase of circulation is transitory. In fevers there is an increased redness in the mucous membrane, and this continues as long as the fever lasts. In some diseases red spots or streaks form in the mucous membrane. This usually indicates an infectious disease of considerable severity and occurs in blood poisoning, purpura hemorrhagica, hemorrhagic septicemia, and in urticaria. When the liver is deranged and does not operate or when the red blood corpuscles are broken down, as in serious cases of influenza, there is a yellowish discoloration of the mucous membrane. The mucous membranes become bluish or blue when the blood is imperfectly oxidized and contains an excess of carbon dioxide. This condition exists in any serious disease of the respiratory tract, as pneumonia, and in heart failure.

The temperature of the skin varies with the temperature of the body. If there is fever the temperature of the skin is likely to be increased. Sometimes, however, as a result of poor circulation and irregular distribution of the blood, the body may be warmer than normal, whereas the extremities (the legs and ears) may be cold. When the general surface of the body becomes cold, it is evident that the small blood vessels in the skin have contracted and are keeping the blood away, as during a chill, or that the heart is weak and is unable to pump the blood to the surface, and that the animal is on the verge of collapse.

The skin is moist, to a certain degree, at all times in a healthy horse. This moisture is not in the form of a perceptible sweat, but it is enough to keep the skin pliable and to cause the hair to feel soft and healthy to the touch. In some chronic diseased conditions and in fever, the skin becomes dry. In this case the hair feels harsh and quite different from the condition observed in health, and from the fact of its being so dry the individual hairs do not adhere to one another but stand apart, and the animal has what is known as "a staring coat." When sweating occurs during a fever, it is usually an indication that the crisis is passed. Sometimes sweating is an indication of pain. A horse with tetanus or azoturia sweats profusely. Horses sweat freely when there is a serious impediment to

respiration; they sweat under excitement, and, of course, from the well-known physiological causes of heat and work. Local sweating, or sweating of a restricted area of the body, denotes some kind of nerve interference.

Swelling of the skin usually comes from wounds or other external causes and has no special connection with the diagnosis of internal diseases. There are, however, a number of conditions in which the swelling of the skin is a symptom of a derangement of some other part of the body. For example, there is the well-known "stocking," or swelling of the legs about the fetlock joints, in influenza. There is the soft swelling of the hind legs that often occurs in draft horses when standing still and that comes from previous inflammation (lymphangitis) or from insufficient heart power. Dropsy, or edema of the skin, may occur beneath the chest or abdomen from heart insufficiency or from chronic collection of fluid in the chest or abdomen (hydrothorax, ascites, or anemia). In anasarca or purpura hemorrhagica large soft swellings appear on any part of the skin but usually on the legs, side of the body, and about the head.

Gas collects under the skin in some instances. This comes from a local inoculation with an organism that produces a fermentation beneath the skin and causes the liberation of gas that inflates the skin, or the gas may be air that enters through a wound penetrating some air-containing organ, as the lungs. The condition here described is known as emphysema. Emphysema may follow the fracture of a rib when the end of a bone is forced inward and caused to penetrate the lung, or it may occur when, as a result of an ulcerating process, an organ containing air is perforated. This accident is more common in cattle than in horses. Emphysema is recognized by the fact that the swelling that it causes is not hot or sensitive on pressure. It emits a peculiar crackling sound when it is stroked or pressed upon.

Wounds of the skin may be of importance in the diagnosis of internal disease. Wounds over the bony prominence, as the point of the hip, the point of the shoulder, and the greatest convexity of the ribs, occur when a horse is unable to stand for a long time and, through continually lying on its side, has shut off the circulation to the portion of the skin that covers parts of the body that carry the greatest weight, and in this way has caused them to mortify. Little, round, soft, doughlike swellings occur on the skin and may be scattered freely over the surface of the body when the horse is afflicted with urticaria. Similar eruptions, but distributed less generally, about the size of a silver dollar, may occur as a symptom of dourine, or colt distemper. Hard lumps, from which radiate weltlike swellings of the lymphatics, occur in glanders, and blisterlike eruptions occur around the mouth and pasterns in horsepox.

ORGANS OF CIRCULATION

The first step in this part of the examination consists in taking the pulse. The pulse may be counted and its character may be determined at any point where a large artery occupies a situation close to the skin and above a hard tissue, such as a bone, cartilage, or tendon. The most convenient place for taking the pulse of the horse is at the jaw. The external maxillary artery runs from between the jaws, around the lower border of the jawbone, and up on the outside of the jawbone to the face. It is located immediately in front of the heavy muscles of the cheek. Its throb can be felt most distinctly just before it turns around the lower border of the jawbone. The balls of the first and second or of the second and third fingers should be pressed lightly on the skin over this artery when its pulsations are to be studied.

The normal pulse of the healthy horse varies in frequency as follows:

	<i>Beats per minute</i>
Stallion.....	28 to 32
Gelding.....	33 to 38
Mare.....	34 to 40
Colt 2 to 3 years old.....	40 to 50
Colt 6 to 12 months old.....	45 to 60
Colt 2 to 4 weeks old.....	70 to 90

The pulse is accelerated by the digestion of rich feeds, by hot weather, exercise, excitement, and alarm. It is slightly more rapid in the evening than in the morning. Well-bred horses have a slightly more rapid pulse than sluggish, cold-blooded horses. The pulse should be regular, that is, the separate beats should follow one another after intervals of equal length, and the beats should be of equal fullness, or volume.

In disease, the pulse may become slower or more rapid than in health. Slowing of the pulse may be caused by old age, great exhaustion, or excessive cold. It may be due to depression of the central nervous system, as in dumminess, or to the administration of drugs, such as digitalis or strophanthus. A rapid pulse is almost always found in fever, and the more severe the infection and the weaker the heart the more rapid is the pulse. Under these conditions, the beats may rise to 80, 90, or even 120 per minute. When the pulse is above 100 per minute the outlook for recovery is not promising, and especially if this symptom accompanies high temperature or occurs late in an infectious disease. In nearly all the diseases of the heart and in anemia the pulse becomes rapid.

The pulse is irregular in diseases of the heart and especially when the valves are affected. The irregularity may consist in varying intervals between the beats or the dropping of one or more beats at regu-

lar or irregular intervals. The latter condition sometimes occurs in chronic diseases of the brain. The pulse is said to be weak, or soft, when the beats are indistinct, because little blood is forced through the artery by each contraction of the heart. This condition occurs when there is a constriction of the vessels leading from the heart, and it occurs in certain infectious and febrile diseases and is an indication of heart weakness.

In examining the heart itself it is necessary to recall that it lies in the anterior portion of the chest slightly to the left of the median line and that it extends from the third to the sixth rib. It extends almost to the breastbone and a little more than half of the distance between the breastbone and the backbone. In contracting, it rotates slightly on its axis, so that the point of the heart, which lies below, is pressed against the left chest wall at a place immediately above the point of the elbow. The heart has in it four chambers—two in the left and two in the right side. The upper chamber of the left side (left auricle) receives the blood as it comes from the lungs, passes it to the lower chamber of the left side (left ventricle) and from here it is sent with great force (for this chamber has very strong, thick walls) through the aorta and its branches (the arteries) to all parts of the body. The blood returns through the veins to the upper chamber of the right side (right auricle) passes then to the lower chamber of the right side (right ventricle), and from this chamber is forced into the lungs to be oxidized. The openings between the chambers of each side and into the aorta are guarded by valves.

If the horse is not too fat, one may feel the impact of the apex of the heart against the chest wall with each contraction of the heart by placing the hand on the left side back of the fifth rib and above the point of the elbow. The thinner and the better bred the horse is, the more distinctly this impact is felt. If the animal is excited, or if it has just been exercised, the impact is stronger than when the horse is at rest. If the horse is weak, the impact is reduced in force.

The examination of the heart with the ear is an important matter in this connection. Certain sounds are produced by each contraction of the normal heart. It is customary to divide these into two, and to call them the first and second sounds. These two sounds are heard during each pulsation, and any deviation of the normal indicates some alteration in the structure or the functions of the heart. In making this examination, one may apply the left ear over the heavy muscles of the shoulder back of the shoulder joint, and just above the point of the elbow or, if the sounds are not heard distinctly, the left foreleg may be drawn forward by an assistant and the right ear placed against the lower portion of the chest wall that is exposed in this manner.

The first sound of the heart occurs while the heart muscle is contracting and while the blood is being forced from the heart, and the valves are rendered taut to prevent the return of the blood from the lower to the upper chambers. The second sound follows quickly after the first and occurs during rebound of blood in the arteries, causing pressure in the aorta and tensions of the valves guarding its opening into the left ventricle. The first sound is of a high pitch and is longer and more distinct than the second. Under the influence of disease these sounds may be altered in various ways. It is not practicable, in a publication such as this, to describe the details of these alterations. Those who are interested will find this subject fully discussed in the veterinary textbooks.

TEMPERATURE

The temperature of the horse may be determined roughly by placing the fingers in the mouth or between the thighs or by allowing the horse to exhale against the cheek or back of the hand. In accurate examination, however, it is necessary to use the thermometer. The thermometer used for taking the temperature of a horse is a self-registering clinical thermometer, similar to that used by physicians, but larger, being from 5 to 6 inches long. The temperature of the animal is measured in the rectum.

The normal temperature of the horse varies somewhat under different conditions. It is higher in the young animal than in the old and is higher in hot weather than in cold. Weather and exercise decidedly influence the temperature physiologically. The normal temperature varies from 99.5° to 101° F. If the temperature rises to 102.5° the horse is said to have a low fever, if the temperature reaches 104° the fever is moderate, if it reaches 106° it is high, and above this point it is regarded as very high. In some diseases, such as tetanus or heatstroke, the temperature becomes as high as 108° to 110°. In the ordinary infectious diseases it does not often exceed 106°. A temperature of 107.5° and above is very dangerous and must be reduced promptly if the horse is to be saved.

ORGANS OF RESPIRATION

In examining these organs and their functions it is customary to begin by noting the frequency of the respiratory movements. This point can be determined by observing the motions of the nostrils or of the flanks; on a cold day one can see the condensation of the moisture of the warm air as it comes from the lungs. The normal rate of respiration for a healthy horse at rest is 8 to 16 per minute. The rate is faster in young animals than in old and is increased by work, hot

weather, overfilling of the stomach, pregnancy, lying on the side, and other causes. Acceleration of the respiratory rate where no physiological cause operates is due to a variety of conditions. Among these are fever, restricted area of active lung tissue from filling of portions of the lungs with inflammatory exudate as in pneumonia, compression of the lungs or loss of elasticity, pain in the muscles controlling the respiratory movements, excess of carbon dioxide in the blood, and constriction of the air passages leading to the lungs.

Difficult or labored respiration is known as dyspnea. It occurs when it is difficult, for any reason, for the animal to obtain the amount of oxygen that it requires. This may be due to filling of the lungs as in pneumonia, to painful movements of the chest as in rheumatism or pleurisy, to tumors of the nose and paralysis of the throat, swellings of the throat, foreign bodies, or weakness of the respiratory passages, fluid in the chest cavity, adhesions between the lungs and chest walls, loss of elasticity of the lungs, and other causes. When the difficulty is great the accessory muscles of respiration are brought into play. In great dyspnea the horse stands with its front feet apart, the neck straight out, and the head extended upon the neck. The nostrils are widely dilated, the face has an anxious expression, the eyeballs protrude, the up-and-down motion of the larynx is aggravated, the amplitude of the movement of the chest walls increased, and the flanks heave.

The expired air is of about the temperature of the body. It contains considerable moisture, and it should come with equal force from each nostril and should not have an unpleasant odor. If the stream of air from one nostril is stronger than from the other, there is an indication of an obstruction in a nasal chamber. If the air has a bad odor, it is usually an indication of putrefaction of a tissue or secretion in some part of the respiratory tract. A bad odor is found if there is necrosis of the bone in the nasal passages or in chronic catarrh. An ulcerating tumor of the nose or throat may cause the breath to have an offensive odor. The most offensive breath occurs where there is necrosis, or gangrene, of the lungs.

In some diseases there is a discharge from the nose. In order to determine the significance of the discharge it should be examined closely. One should ascertain whether it comes from one or both nostrils. If but from one nostril, it probably originates in the head. The color should be noted. A thin, watery discharge may be composed of serum, and it occurs in the earlier stages of coryza, or nasal catarrh. An opalescent, slightly tinted discharge is composed of mucus and indicates a little more severe irritation. If the discharge is sticky and puslike, a deeper difficulty or more advanced irritation is indicated. If the discharge contains flakes and clumps of

more or less dried, agglutinated particles, it probably originates within a cavity of the head, as the sinuses or guttural pouches. The discharge of glanders is of a peculiar sticky nature and adheres tenaciously to the wings of the nostrils. The discharge of pneumonia is somewhat red or reddish-brown and, on this account, has been described as a prune-juice discharge. The discharge may contain blood. If the blood appears as clots or as streaks in the discharge, it probably originates at some point in the upper part of the respiratory tract. If the blood is in the form of a fine froth, it comes from the lungs.

In examining the interior of the nasal passage one should remember that the normal color of the mucous membrane is a rosy pink and that its surface is smooth. If ulcers, nodules, swellings, or tumors are found, these indicate disease. The ulcer that is characteristic of glanders is described fully in connection with the discussion of that disease.

Between the lower jaws there are several clusters of lymphatic glands. These glands are so small and soft that it is difficult to find them by feeling through the skin, but when a suppurative disease exists in the upper part of the respiratory tract these glands become swollen and easy to feel. They may become soft and break down and discharge as abscesses; this is seen constantly in strangles. On the other hand, they may become indurated and hard from the proliferation of connective tissue and attach themselves to the jawbone, tongue, or skin. This is seen in chronic glanders. If the glands are swollen and tender to pressure, it indicates that the disease causing the enlargement is acute; if they are hard and insensitive, the disease causing the enlargement is chronic.

The manner in which the horse coughs is of importance in diagnosis. The cough is a forced expiration, following immediately on a forcible separation of the vocal cords. The purpose of the cough is to remove some irritant substance from the respiratory passages, and it occurs when irritant gases, such as smoke, ammonia, sulphur vapor, or dust, have been inhaled. It occurs from inhalation of cold air if the respiratory passages are sensitive from disease. In laryngitis, bronchitis, and pneumonia, cough is easily excited and occurs merely from accumulation of mucus and inflammatory product on the irritated respiratory mucous membrane. If one wishes to determine the character of the cough, it can easily be excited by pressing on the larynx with the thumb and finger. The larynx should be pressed from side to side and the pressure removed the moment the horse commences to cough. A painful cough occurs in pleurisy, laryngitis, bronchitis, and bronchial pneumonia. Pain is shown by the effort to repress the cough. The cough is not painful, as a rule, in the chronic diseases of the respiratory tract. The force of the cough is con-

siderable when it is not especially painful and when the lungs are not seriously involved. The cough is weak when the lungs are so diseased that they cannot be filled with a large volume of air, in heaves and in weak, debilitated animals. If mucus or pus is coughed out, or if the cough is accompanied with a gurgling sound, it is said to be moist; it is dry when these characteristics are not present—that is, when the air in passing out passes over surface not loaded with secretion.

In the examination of the chest, one resorts to percussion and auscultation. When a cask or other structure containing air is tapped upon, or percussed, a hollow sound is given forth. If the cask contains fluid, the sound is dull and of a different character. Similarly, the amount of air contained in the lungs can be estimated by tapping upon, or percussing, the walls of the chest. Percussing is practiced with the fingers alone or with the aid of a special percussion hammer and an object to strike upon known as a pleximeter. If the fingers are used, the middle finger of the left hand should be pressed firmly against the side of the horse and struck with the ends of the fingers of the right hand bent at a right angle to form a hammer. The percussion hammer sold by instrument makers is made of rubber or has a rubber tip, so that when the pleximeter, which is placed against the side, is struck, the impact will not be accompanied with a noise. After experience in this method of examination, one can determine with considerable accuracy whether the lung contains a normal amount of air. If, as in pneumonia, air has been displaced by inflammatory product occupying the air space, or if fluid collects in the lower part of the chest, the percussion sound becomes dull. If, as in emphysema or in pneumothorax, there is an excess of air in the chest cavity, the percussion sound becomes abnormally loud and clear.

Auscultation consists in the examination of the lungs with the ear applied closely to the chest wall. As the air goes in and out of the lungs a certain soft sound is made that can be heard distinctly, especially on inspiration. This sound is intensified by anything that accelerates the rate of respiration, such as exercise. This soft, rustling sound is known as vesicular murmur, and wherever it is heard it signifies that the lung contains air and is functionally active. The vesicular murmur is weakened when there is an inflammatory infiltration of the lung tissue or when the lungs are compressed by fluid in the chest cavity. The vesicular murmur disappears when air is excluded by the accumulation of inflammatory product, as in pneumonia, and when the lungs are compressed by fluid in the chest cavity. The vesicular murmur becomes rough and harsh in the early stages of inflammation of the lungs, and this is often the first sign of the beginning of pneumonia.

By applying the ear over the lower part of the windpipe in front of the breastbone a somewhat harsh, blowing sound may be heard. This

is known as the bronchial murmur and is heard in normal conditions near the lower part of the trachea and to a limited extent in the anterior portions of the lungs after sharp exercise. When the bronchial murmur is heard over other portions of the lungs, it may signify that the lungs are more or less solidified by disease and the blowing bronchial murmur is transmitted through this solid lung to the ear from a distant part of the chest. The bronchial murmur in an abnormal place signifies that pneumonia exists there or that the lungs are compressed by fluid in the chest cavity.

Additional sounds are heard in the lungs in some diseased conditions, for example, when fluid collects in the air passages and the air is forced through it or is caused to pass through tubes containing secretions or pus. Such sounds are of a gurgling or bubbling nature and are known as mucous râles. These are spoken of as being large or small as they are distinct or indistinct, depending on the quantity of fluid present and the size of the tube in which this sound is produced. Mucous râles occur in pneumonia after the solidified parts begin to break down at the end of the disease. They occur in bronchitis and in tuberculosis, where there is an excess of secretion.

Sometimes a shrill sound is heard, like the note of a whistle, fife, or flute. This is due to a dry constriction of the bronchial tubes and occurs in chronic bronchitis and in tuberculosis.

A friction sound is heard in pleurisy. This is due to the rubbing together of roughened surfaces and the sound produced is similar to a dry rubbing sound caused by rubbing the hands together or by rubbing upon each other two dry, rough pieces of leather.

EXAMINATION OF THE DIGESTIVE TRACT

The first point in connection with the examination of the organs of digestion is the appetite and the manner of taking feed and drink. A healthy animal has a good appetite. Loss of appetite does not necessarily indicate a special diseased condition, but may result from excitement, strange surroundings, fatigue, and hot weather. However, with cerebral depression, fever, profound weakness, disorder of the stomach, or mechanical difficulty in chewing or swallowing, the appetite is diminished or destroyed. Sometimes there is an appetite or desire to eat abnormal things, such as dirty bedding, roots of grass, or soil. This desire usually comes from a chronic disturbance of nutrition.

Thirst is diminished in many mild diseases unaccompanied with distinct fever. It occurs when there is great exhaustion or depression or profound brain disturbance. Thirst is increased after profuse sweating, in diabetes, diarrhea, in fever, at the crises of infectious diseases, and when the mouth is dry and hot.

Some diseases of the mouth or throat make it difficult for the horse to chew or swallow its feed. When difficulty in this respect is experienced, the following conditions should be carefully looked for: Diseases of the teeth, consisting in decay, fracture, abscess formation, or overgrowth; inflammatory conditions, or wounds or tumors of the tongue, cheeks, or lips; paralysis of the muscles of chewing or swallowing; foreign bodies in the upper part of the mouth between the molar teeth; inflammation of the throat. Difficulty in swallowing is sometimes shown by the symptom known as "quidding," which consists in dropping from the mouth well-chewed and insalivated boluses of feed. A mouthful of hay, for example, after being ground and masticated, is carried to the back part of the mouth. The horse then finds that from tenderness of the throat, or from some other cause, swallowing is difficult or painful, and the bolus is then dropped from the mouth. Another quantity of hay is similarly prepared, only to be dropped in turn. Sometimes quidding is due to a painful tooth, the bolus being dropped from the mouth when the tooth is struck and during the pang that follows. Quidding may be practiced so persistently that a considerable pile of boluses of feed accumulate in the manger or on the floor of the stall. In pharyngitis one of the symptoms is a return through the nose of fluid that the horse attempts to swallow.

In some brain diseases, and particularly in chronic internal hydrocephalus, the horse has a peculiar manner of swallowing and of taking feed. A similar condition is seen in hyperemia of the brain. In eating, the horse sinks its muzzle into the grain in the feed box and eats for a while without raising its head. Long pauses are made while the feed is in the mouth. Sometimes the horse eats rapidly for a while and then slowly; the jaws may be brought together so forcibly that the teeth gnash. In eating hay the horse stops at times with hay protruding from the mouth and stands stupidly.

In examining the mouth one should first look for swellings or for evidence of abnormal conditions on the exterior, that is, the front and sides of the face, the jaws, and about the muzzle. By this means wounds, fractures, tumors, abscesses, and disease accompanied with eruptions about the muzzle may be detected. The interior of the mouth is examined by holding the head up and inserting the fingers through the interdental space in such a way as to cause the mouth to open. The mucous membrane should be clean and of a light-pink color, except on the back of the tongue, where the color is a yellowish gray. The chief abnormalities of this region are diffuse inflammation, characterized by redness and catarrhal discharge; local inflammation, as from eruptions, ulcers, or wounds; necrosis of the lower jawbone in front of the first back tooth; and swellings. Foreign bodies are sometimes embedded in the mucous-membrane lining of the mouth or lodged between the teeth.

Examination of the pharynx and the esophagus is made chiefly by pressing on the skin covering these organs in the region of the throat and along the left side of the neck in the jugular gutter. Sometimes, when a more careful examination is necessary, an esophageal tube or probang is passed through the nose or mouth down the esophagus to the stomach.

Vomiting consists in the expulsion of all or part of the contents of the stomach through the mouth or nose. This act is more difficult for the horse than for most of the other domestic animals, because the stomach of the horse is small and does not lie on the floor of the abdominal cavity, so that the abdominal walls in contracting do not bring pressure to bear on it so directly and forcibly as is the case in many other animals. Besides this, there is a loose fold of mucous membrane at the point where the esophagus enters the stomach, and this forms a sort of valve that does not interfere with the passage of feed into the stomach but does interfere with the exit of feed through the esophageal opening. Still, vomiting is occasionally seen in the horse. It occurs when the stomach is very much distended with feed or with gas. Distention stretches the mucous membrane and eradicates the valvular fold referred to, and also makes it possible for more pressure to be exerted on the stomach through the contraction of the abdominal muscles. Since the distention to permit vomiting must be extreme, it frequently leads to rupture of the stomach walls. This has caused the impression in the minds of some that vomiting cannot occur in the horse without rupture of the stomach, but this is incorrect, since many horses vomit and afterwards become entirely sound. After rupture of the stomach has occurred vomiting is impossible.

In examination of the abdomen one should remember that its size depends largely on the breed, sex, and conformation of the animal, and also on the manner in which the animal has been fed and the use to which it has been put. A pendulous abdomen may be the result of an abdominal tumor or of an accumulation of fluid in the abdominal cavity, or, it may merely be an indication of pregnancy or of the fact that the horse has been fed for a long time on bulky feed. A pendulous abdomen in a work horse kept on a concentrated diet is an abnormal condition. The abdomen may increase suddenly in volume from accumulation of gas in tympanic colic. The abdomen becomes small and the horse is said to be "tucked up" from long-continued poor appetite, as in diseases of the digestive tract and in fever. This condition also occurs in tetanus from the contraction of the abdominal walls and in diarrhea from emptiness.

In applying the ear to the flank, on either the right or left side, certain bubbling sounds may be heard that are known as peristaltic sounds, because they are produced by peristalsis, or wormlike con-

traction of the intestines. These sounds are a little louder on the right side than on the left as the large intestines lie in the right flank. Absence of peristaltic sounds is always an indication of disease and suggests exhaustion or paralysis of the intestines. This may occur in certain kinds of colic and is an unfavorable symptom. Increased sounds are heard when the intestines are contracted more violently than in health, as in spasmodic colic, and also when there is an excess of fluid or gas in the intestinal canal.

The feces show, to a certain extent, the thoroughness of digestion. They should show that the feed has been well ground and, in the horse, should be free from offensive odor or coatings of mucus. A coating of mucus shows intestinal catarrh. Blood on the feces indicates severe inflammation. Very light color and bad odor may come from inactive liver. Parasites are sometimes in the dung.

Rectal examination consists in examination of the organs of the pelvic cavity and posterior portion of the abdominal cavity by the hand inserted into the rectum. This examination should be attempted by a veterinarian only and is useless except to one who has a good knowledge of the anatomy of the parts concerned.

EXAMINATION OF THE NERVOUS SYSTEM

The great brain, or cerebrum, is the seat of intelligence, and it contains the centers that control motion in many parts of the body. The front portion of the brain is believed to be the region that is most important in governing the intelligence. The central and posterior portions of the cerebrum contain the centers for the voluntary motions of the face and of the front and hind legs. The growth of a tumor or an inflammatory change in the region of a center governing the motion of a certain part of the body disturbs motion in that part by causing excessive contraction known as cramps, or inability of the muscles to contract, constituting the condition known as paralysis. The nerve paths from the cerebrum, and hence from these centers to the spinal cord and thence to the muscles, pass beneath the small brain, or the cerebellum, and through the medulla oblongata to the spinal cord. Interference with these paths has the effect of disturbing motion of the parts reached by them. If all the paths on one side are interfered with, the result is paralysis of one side of the body.

The small brain, or cerebellum, governs the regularity, or coordination, of movements. Disturbances of the cerebellum cause a tottering, uncertain gait. In the medulla oblongata, which lies between the spinal cord and the cerebellum, are the centers governing the circulation and breathing.

The spinal cord carries sensory messages to the brain and motor impressions from the brain. The anterior portions of the cord contain

the motor paths, and the posterior portions of the cord contain the sensory paths.

Paralysis of a single member or a single group of muscles is known as *monoplegia* and results from injury to the motor center or to a nerve trunk leading to the part that is involved. Paralysis of one-half of the body is known as *hemiplegia* and results from destruction or severe disturbances of the cerebral hemisphere of the opposite side of the body or from interference with nerve paths between the cerebellum, or small brain, and the spinal cord. Paralysis of the posterior half of the body is known as *paraplegia* and results from derangement of the spinal cord. If the cord is pressed upon, cut, or injured, messages cannot be transmitted beyond that point, and so the posterior part becomes paralyzed. This occurs when the back is fractured.

Abnormal mental excitement may be due to congestion of the brain or to inflammation. The animal so afflicted becomes vicious, pays no attention to commands, cries, runs about in a circle, stamps with the feet, strikes, and kicks. This condition is usually followed by a dull, stupid state, in which the animal stands with its head down, dull, and irresponsive to external stimuli. Cerebral depression also occurs in the severe febrile infectious diseases, chronic hydrocephalus, botulism, chronic diseases of the liver, poisoning with a narcotic substance, and chronic catarrh of the stomach and intestines.

Fainting is not often seen in horses. When it occurs it is shown by unsteadiness of gait, tottering, and, finally, inability to stand. The cause usually lies in a defect of the small brain, or cerebellum. This defect may be merely in respect to the blood supply, congestion, or anemia, and in this case it is likely to pass away and may never return, or it may be due to some permanent cause, as a tumor or an abscess, or it may result from hemorrhage, a defect of the valves of the heart, or poisoning.

Loss of consciousness is known as *coma*. It is caused by hemorrhage in the brain, profound exhaustion, or saturation of the system with the poison of some disease. Coma may follow cerebral depression, which occurs as a secondary state of inflammation of the brain.

When the sensibility of a part is increased the condition is known as *hyperesthesia*, and when it is lost—that is, when there is no feeling or knowledge of pain—the condition is known as *anesthesia*. The former usually accompanies some chronic disease of the spinal cord or the earlier stages of irritation of a nerve trunk. *Hyperesthesia* is difficult to detect in a nervous, irritable animal, and sometimes even in a horse of less sensitive temperament. An irritable, sensitive spot may be surrounded by skin that is not sensitive to pressure. This is sometimes a symptom of beginning of inflammation of the brain. *Anesthesia* occurs in connection with cerebral and spinal paralysis,

section of a nerve trunk leading to a part, severe mental depression, and narcotic poisoning.

URINARY AND SEXUAL ORGANS

In considering the examination of the urinary and sexual organs, it is desired, at the beginning, to correct a false impression that prevails to an astonishing extent. Many horsemen are in the habit of pressing on the back of a horse over the loins or of sliding the ends of the fingers along on either side of the median line of this region. If the horse depresses his back it is at once said "his kidneys are weak." Nothing could be further from the truth. Any healthy horse—any horse with normal sensation and with a normally flexible back—will cause it to sink when manipulated in this way. If the kidneys are inflamed and sensitive, the back is held more rigidly and is not depressed under this pressure.

To examine the kidneys by pressure, the pressure should be brought to bear over these organs. The kidneys lie beneath the ends of the transverse processes of the vertebrae of the loins and beneath the hindmost ribs. If the kidneys are actually inflamed and especially sensitive, pressure or light blows applied here may cause the horse to shrink.

The physical examination of the genital organs is made in large part through the rectum, and this portion of the examination should be carried out by a veterinarian only. By this means it is possible to discover or locate cysts of the kidneys or ovaries, urinary calculi in the ureters, bladder, or upper urethra, malformations, and acute inflammations accompanied with pain. The external genital organs are swollen, discolored, or show a discharge as a result of local disease or from disease higher in the tract.

The manner of urinating is sometimes of considerable diagnostic importance. Painful urination is shown by frequent attempts, during which but a small quantity of urine is passed; by groaning, by constrained attitude; and similar symptoms. This condition comes from inflammation of the bladder or urethra, urinary calculi (stones of the bladder or urethra), hemorrhage, tumors, bruises, and other causes. The urine is retained from spasms of the muscle at the neck of the bladder, from calculi, inflammatory growths, tumors, and paralysis of the bladder.

The urine dribbles without control when the neck of the bladder is weakened or paralyzed. This condition is seen after the bladder is weakened from long-continued retention and where there is a partial paralysis of the hind quarters.

Horses usually void urine five to seven times a day and pass from 4 to 7 quarts. Disease may be shown by increase in the number of

voidings or of the quantity. Frequent urination indicates an irritable or painful condition of the bladder or urethra or that the quantity is excessive. In one form of chronic inflammation of the kidneys (interstitial nephritis) and in polyuria the quantity may be increased to 20 to 30 quarts daily. Diminution in the quantity of urine comes from profuse sweating, diarrhea, high fever, weak heart, diseased and nonsecreting kidneys, or an obstruction to the flow.

The urine of the healthy horse is a pale or at times a slightly reddish yellow. The color is less intense when the quantity is large and is more intense when the quantity is diminished. Dark-brown urine is seen in azoturia and in severe acute muscular rheumatism. A brownish-green color is seen in jaundice. Red color indicates admixture of blood from a bleeding point at some part of the urinary tract, usually in the kidneys.

The urine of the healthy horse is not clear and transparent. It contains mucus, which causes it to be slightly thick and stringy, and a certain amount of undissolved carbonates, causing it to be cloudy. A sediment collects when the urine is allowed to stand. The urine of the horse is normally alkaline. If it becomes acid the bodies in suspension are dissolved and the urine is made clear. The urine may be unusually cloudy from the addition of abnormal constituents, but to determine their character a chemical or microscopic examination is necessary. Red or reddish flakes or clumps in the urine are always abnormal and denote a hemorrhage or suppuration in the urinary tract.

The normal specific gravity of the urine of the horse is about 1.040. It is increased when the urine is scanty and decreased when the quantity is excessive.

Acid reaction of the urine occurs in chronic intestinal catarrh, in high fever, and during starvation. Chemical and microscopic tests and examinations are often of great importance in diagnosis but require special apparatus and skill.

Other points in the examination of a sick horse require more discussion than can be afforded in this connection and require special training on the part of the examiner. Among such points are the examination of the organs of special sense, examination of the blood, microscopic examination of the secretions and excretions, bacteriological examinations of the secretions, excretions, and tissues, specific reaction tests, and diagnostic inoculation.

Fundamental Principles of Disease

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ANIMAL TISSUES

All tissues are composed of certain fundamental and similar elements that are governed by the same rules of life, though at first glance they may appear to be widely different. These are (a) amorphous substances, (b) fibers, and (c) cells.

(a) Amorphous substances may be in liquid form, as in the fluid of the blood, which holds a vast amount of salts and nutritive matter in solution; or they may be in a semiliquid condition, as the plasma that infiltrates the loose meshes of connective tissue and lubricates the surface of some membranes; or they may be in the form of a glue or cement, fastening one structure to another, as a tendon or muscle end to a bone; or again, they hold similar elements firmly together, as in bone, where they form a stiff matrix that becomes impregnated with lime salts. Amorphous substances, again, form the protoplasm or nutritive element of cells or the elements of life.

(b) Fibers are formed of elements of organic matter that have only a passive function. They can be assimilated to little strings, or cords, tangled one with another like a mass of waste yarn, woven regularly like a cloth, or bound together like a rope. They are of two kinds—white, connective-tissue fibers, only slightly extensible, pliable, and very strong, and yellow elastic fibers, elastic, curly, ramified, and very dense. These fibers once created require the constant presence of fluids around them to retain their functional condition, as a piece of harness leather demands continual oiling to keep its strength, but they undergo no change or alteration in their form until destroyed by death.

(c) Cells are small masses of protoplasm, or minute units of living matter, that compose the various tissues of the body. The cells are capable of assimilating nutriment and of propagation by dividing into multiplied segments.

It is simply the mode of the grouping of these elements that causes the variation in tissues, as (1) loose connective tissue, (2) aponeurosis and tendons, (3) muscles, (4) cartilage, (5) bones, (6) epithelia and endothelia, (7) nerves.

(1) Loose connective tissue forms the great framework, or scaffolding, of the body, and is found under the skin, between the muscles

surrounding the bones and blood vessels, and entering into the structures of almost all the organs. In this the fibers are loosely meshed together like a sponge, leaving spaces in which the nutrient fluid and cells are irregularly distributed. This tissue is found in the skin, in the spaces between the organs of the body where fat accumulates, and as the framework of all glands.

(2) Aponeurosis and tendons are structures that serve for the termination of muscles and for their contention and for the attachment of bones. In these the fibers are more frequent and dense and are arranged with regularity, either crossing each other or lying parallel, and here the cells are found in minimum quantity.

(3) In the muscles the cells lie end to end, forming long fibers that have the power of contraction, and the connective tissue is in small quantity, serving the passive purpose of a band around the contractile elements.

(4) In cartilage a mass of firm amorphous substance, with no vascularity and little vitality, forms the bed for the chondroplasts, or cells of this tissue.

(5) Bone differs from cartilage in having the amorphous matter impregnated with lime salts, which gives it its rigidity and firmness.

(6) Epithelia and endothelia, or the membranes that cover the body and line all its cavities and glands, are made up of single or stratified and multiple layers of cells bound together by a glue of amorphous substance and resting on a layer composed of fibers. When the membrane serves for secreting or excreting purposes, as in the salivary glands or the kidneys, it is usually simple; when it serves the mechanical purpose of protecting a part, as over the tongue or skin, it is invariably multiple and stratified, the surface wearing away while new cells replace it from beneath.

(7) In nerves, stellate cells are connected by their rays to each other or to fibers that conduct the nerve impressions, or they act as receptacles, storehouses, and transmitters for them, as the switch-board of a telephone system serves to connect the various wires.

All these tissues are supplied with blood in greater or less quantity. The vascularity depends on the function that the tissue is called on to perform. If this is great, as in the tongue, the lungs, or the sensitive part of the hoof, a large quantity of blood is required; if the labor is a passive one, as in cartilage, the membrane over the withers, or the tendons of the legs, the vessels reach only the periphery, and nutrition is furnished by absorption of the fluids brought to their surface by the blood vessels.

Blood is brought to the tissues by arterioles, or the small terminations of the arteries, and is carried off from them by the veinlets, or the commencement of the veins. Between these two systems are

small, delicate networks of vessels called capillaries, which subdivide into a veritable lacework to reach the neighborhood of every element.

In health the blood passes through these capillaries with a regular current, the red cells or corpuscles floating rapidly in the fluid in the center of the channel, whereas the white or ameboid cells are attracted to the walls of the vessels and move very slowly. The supply of blood is regulated by the repose or the activity of the tissue, and under normal conditions the outflow exactly compensates for the supply. The caliber of the blood vessels, and consequently the quantity of blood which they carry, is governed by nerves of the sympathetic system in a healthy body with unerring regularity, but in a diseased organ the flow may be greatly augmented or diminished or may cease entirely. In health a tissue or organ receives its proper quantity of blood; the nutritive elements are extracted for the support of the tissue and for the product, which is the function of the organ forms. The force required in the achievement of this is furnished by combustion of the nutrients by the oxygen brought by the arterial blood, then by the veins this same fluid passes off, less its oxygen, loaded with the waste products, which are the result of the worn-out and disintegrated tissues and of those which have undergone combustion. The foregoing brief outline indicates the process of nutrition of the tissues.

Hypernutrition, or excessive nutrition of a tissue, may be normal or morbid. If the latter, the tissue becomes congested or inflamed.

CONGESTION

Congestion is an unnatural accumulation of blood in a part. Excessive accumulation of blood may be normal, as occurs temporarily after violent muscular effort, in the stomach or liver during digestion, or in the lungs after severe work, from which, in the last-mentioned case, it is shortly relieved by a little rapid breathing. The term "congestion," however, usually indicates a morbid condition, with more or less lasting effects. Congestion is active or passive. The former is produced by an increased supply of blood to the part, the latter by an obstacle preventing the escape of blood from the tissue. In either case there is an increased supply of blood and, as a result, increased combustion and augmented nutrition.

ACTIVE CONGESTION

Active congestion is caused by—

(1) *Functional activity*.—Any organ that is constantly or excessively used becomes accustomed to hold an unusual quantity of blood; the vessels become dilated; if overstrained the walls become weakened, lose their elasticity, and any sudden additional quantity of blood engorges the tissues so that they cannot contract, and congestion

results. A good example is shown in the lungs of a race horse, after an unusual burst of speed or severe work in damp weather.

(2) *Irritants*.—These are heat and cold, chemical or mechanical. Any of these—a hot iron, frostbites, acids, or a blow—by threatening the vitality of a tissue, induce immediately an augmented flow of blood to the part to furnish the means of repair.

(3) *Nerve influence*.—This may produce congestion either by acting on the part reflexly or as the result of some central-nerve disturbance affecting the branch that supplies a given organ.

(4) *Plethora and sanguinary temperament*.—Full-blooded animals are much more predisposed to congestive diseases than those of a lymphatic character or those in an anemic condition. The circulation in them is forced to all parts with much greater force and in large quantities. A well-bred, full-blooded horse is much more subject to congestive diseases than a common, coarse, or old, worn-out animal.

(5) *Fevers*.—In fever the heart works more actively and forces the current of blood more rapidly; the tissues are weakened, and it requires only a slight local cause at any part to congest the structures already overloaded with blood. Again, in certain fevers, there is alteration of the blood itself, rendering it less or more fluid, which interferes with its free passage through the vessels and induces a local predisposition to congestion.

(6) *Warm climate and summer heat*.—Warmth of the atmosphere relaxes the tissues; it demands of the animals less blood to keep up their own body temperature, and the extra quantity accumulates in the blood-vessel system. It causes sluggishness in the performance of the organic functions, and in this way it induces congestion, especially of the internal organs. Therefore founders, congestive colics, and staggers are more frequent in summer than in winter.

(7) *Previous congestion*.—Whether the previous congestion of any organ has been a continuous normal one—that is, a repeated functional activity—or has been a morbid temporary overloading, it always leaves the walls of the vessels weakened and more predisposed to recurrent attacks from accidental causes than are perfectly healthy tissues. Thus a horse that has had a congestion of the lungs from a severe drive is likely to have another attack from even less cause.

The alterations of congestion are distention of the blood vessels, accumulation of the cellular elements of the blood in them, and effusion of a portion of the liquid of the blood into the fibrous tissues that surround the vessels. When the changes produced by congestion are visible, as in the eye, the nostril, the mouth, the genital organs, and on the surface of the body in white or unpigmented animals, the part appears red from the increase of blood; it becomes swollen from the effusion of liquid into the spongelike connective tissues; it is at times more or less hot from the increased combustion;

the part is frequently painful to the animal from pressure of the effusion on the nerves, and the function of the tissue is interfered with. The secretion or excretion of glands may be augmented or diminished. Muscles may be affected with spasms or may be unable to contract. The eyes and ears may be affected with imaginary sights and sounds.

PASSIVE CONGESTION

Passive congestion is caused by interference with the return of the current of blood from a part.

Old age and debility weaken the tissues and the force of the circulation, especially in the veins, and retard the movement of the blood. Horses so affected have stocked legs, swelling of the sheath of the penis or of the milk glands and of the under surface of the belly. There are also effusions of the liquid parts of the blood into the lymph spaces of the posterior extremities and organs of the pelvic cavity.

Tumors or other mechanical obstructions, by pressing on the veins, retard the flow of blood and cause it to back up in distal parts of the body, causing passive congestion.

The alterations of passive congestion, as in active congestion, consist of an increased quantity of blood in the vessels and an exudation of its fluid into the tissues surrounding them, but in passive congestion there is dark, thick blood that has lost its oxygen, instead of the rich, combustible blood rich in oxygen that is found in active congestion.

The termination of congestion is by resolution or inflammation. In the first case, the choked-up blood vessels find an outlet for the excessive quantity of blood and are relieved; the transuded serum or fluid of the blood is reabsorbed, and the part returns almost to its normal condition, with, however, a tendency to weakness predisposing to future trouble of the same kind. In the other case further alterations take place, causing inflammation.

INFLAMMATION

Inflammation is a hypernutrition of a tissue. It is described by Dr. Agnew, the surgeon, as "a double-edged sword, cutting either way for good or for evil." The increased nutrition may be moderate and cause a growth of new tissue, a simple increase of quantity at first; or it may produce a new growth differing in quality; or it may be so great that, like luxuriant, overgrown weeds, the elements die from their very haste of growth and cause immediate destruction of the part. According to the rapidity and intensity of the process of structural changes that takes place in an inflamed tissue, inflammation is described as acute or chronic, with a vast number of intermediate forms. When the phenomena are marked it is termed

sthenic; when less distinct, as the result of a broken-down and feeble constitution in the animal, it is called asthenic. Certain inflammations are specific, as in strangles, horsepox, or glanders, in which characteristic or specific cause or condition is added to the origin, character of phenomena, or alterations that result from an ordinary inflammation. An inflammation may be circumscribed or limited, as in the abscess on the neck caused by the pressure of a collar, in pneumonia, in glanders, in the small tumors of a splint or a jack; or it may be diffuse, as in severe fistulas of the withers, in an extensive lung fever, in the legs in a case of grease, or in the spavins that affect horses with poorly nourished bones. The causes of inflammation are practically the same as those of congestion, which is the initial step of all inflammation.

The temperament of a horse predisposes the animal to inflammation of certain organs. A full-blooded animal, whose veins show on the surface of the body, and that has a strong, bounding heart pumping large quantities of blood into the vascular organs such as the lungs, the intestines, and the laminae of the feet, is more likely to have pneumonia, congestive colics, and founder, than lymphatic, cold-blooded animals that have pleurisies, inflammation of the bones, spavins, ringbones, inflammation of the glands of the less vascular skin of the extremities, grease heels, and thrush.

Young horses have inflammation of the membranes lining the air passages and digestive tract, whereas older animals are more subject to troubles in the closed serous sacs and in the bones.

The work to which a horse is put (saddle or harness, speed or draft) will influence the predisposition of an animal to inflammatory diseases. As in congestion, the functional activity of a part is an important factor in localizing this form of disease. In a group of horses exposed to the same draft of cold air or other exciting cause of inflammation, the one that has just been eating is more likely to be attacked with an inflammation of the bowels; the one that has just been working so as to increase its respiration is more likely to have an inflammation of the throat, bronchi, or lungs; the one that has just been using its feet excessively is more likely to have a founder or inflammation of the laminae of the feet.

The direct cause of inflammation is usually an irritant of some form. This may be a pathogenic organism—a disease germ—or it may be mechanical or chemical, external or internal. Cuts, bruises, injuries of any kind, parasites, acids, blisters, heat, cold, secretions such as an excess of tears over the cheek or urine on the legs—all cause inflammation by direct injury to the part. Strains or wrenches of joints, ligaments, and tendons cause trouble by laceration of the tissue.

Inflammations of the internal organs are caused by irritants as previously described and by sudden cooling of the surface of the animal, which drives the blood to that organ which at the moment is most actively supplied with blood. This is called *repercussion*. A horse that has been worked at speed and is breathing rapidly is likely to have pneumonia if suddenly chilled, whereas an animal that has just been fed is more likely to have a congestive colic if exposed to the same influence, the blood in this case being driven from the exterior to the intestine, whereas in the former it was driven to the lungs.

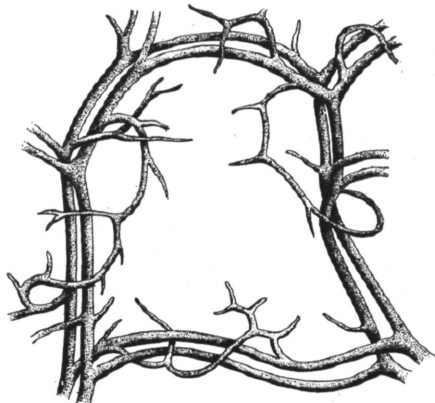
Symptoms.—The symptoms of inflammation are, as in congestion, change of color, due to an increased supply of blood; swelling, from the same cause, with the addition of an effusion into the surrounding tissues; heat, due to the increased combustion in the part; pain, due to pressure on the nerves; and altered function. In addition to the local symptoms, inflammation always produces more or less constitutional disturbance or fever. A splint or small spavin will cause little fever, whereas a severe spavin, an inflamed joint, or pneumonia may give rise to a marked fever.

The alterations in an inflamed tissue are first those of congestion, distention of the blood vessels (pl. I), and exudation of the fluid of the blood into the surrounding fibers, with, however, a more nearly complete stagnation of the blood. Fibrin, or lymph, a plastic substance, is thrown out as well, and the cells, no longer carried in the current of the blood, migrate from the vessels and, finding proper nutriment, proliferate or multiply with greater or lesser rapidity (pl. II). The cells that lie dormant in the meshes of the surrounding fibers are awakened into activity by the nutritious lymph that surrounds them, and they also multiply.

Whether the cell in an inflamed part is the white blood cell or the fixed connective tissue embedded in the fibers, it multiplies in the same way. The nucleus in the center is divided into two, and then each again into two, *ad infinitum*. If the process is slow, each new cell may assimilate nourishment and become, like its ancestor, an aid in the formation of new tissues. If however, the changing takes place rapidly, the young cells do not have time to grow or use up the surrounding nourishment, and, but half developed, they die, causing destruction of tissue, and pus is formed, a material made up of the imperfect dead elements and the broken-down tissue. Between the two there is an intermediate form, such as imperfectly formed tissues, as in "proud flesh," large, soft splints, fungous growths, grease heels, and thrush.

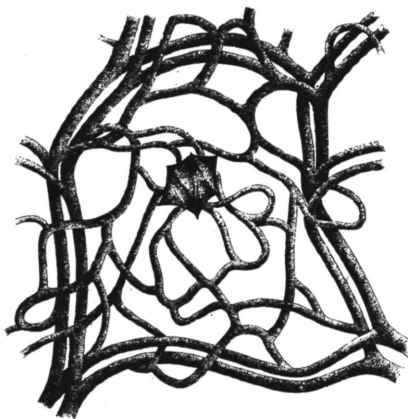
Whether the inflamed tissue is one like the skin, lungs, or intestines, very loose in their texture, or a tendon or bone, dense in structure, and comparatively poor in blood vessels, the principle of the process is the same. The effects, however, and the appearance may

1



1, Uninflamed wing of the bat.

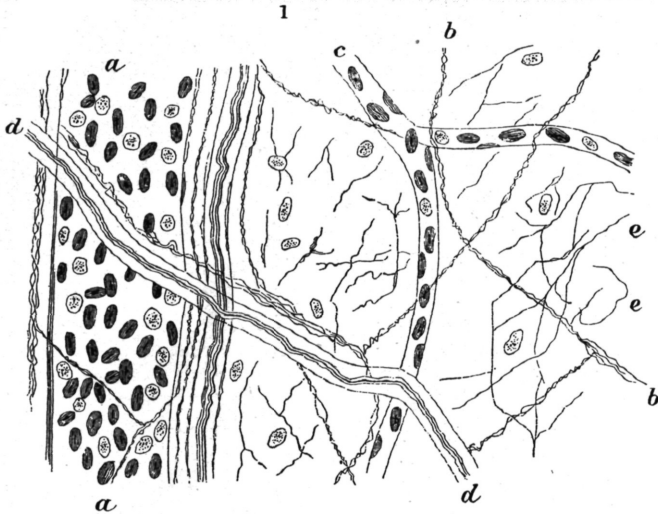
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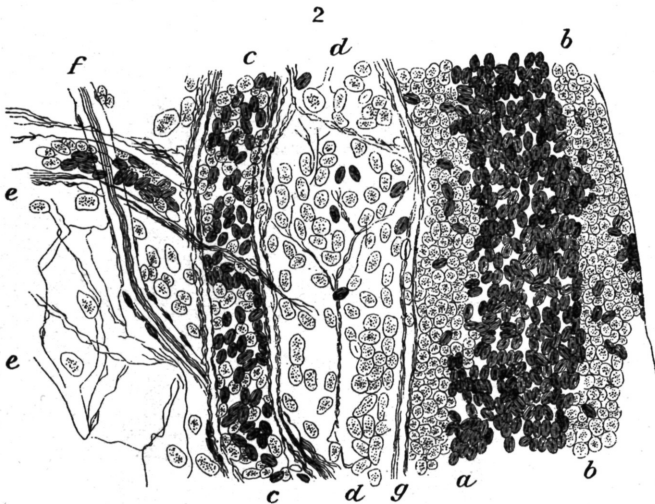
2, Inflamed wing of the bat.

Haines, after Agnew.

INFLAMMATION.



1, Noninflamed mesentery of the frog, 400 diameters, reduced one half. *a, a*, Venule with red and white corpuscles. *b, b*, Gelatinous nerve fiber. *c*, Capillary. *d, d*, Dark-bordered nerve fiber. *e, e*, Connective tissue with connective tissue corpuscles and leucocytes scattered sparsely through it.



Haines, after Agnew.

2, Inflamed mesentery of the frog, 400 diameters, reduced one half. *a, b*, Venule filled with red and white corpuscles, the red in the center and the white crowding along the walls. *c, c*, Capillary distended with red and white corpuscles, number of the white much decreased. *d, d*, Connective tissue between venule and capillary filled with migrated leucocytes. *e, e*, Connective tissue with less infiltration. *f*, Dark-bordered nerve fiber. *g*, Number of nuclei in sheaths increased.

INFLAMMATION.

be widely different. After a cut on the face or an exudation into the lungs, the loose tissues and multiple vessels allow the proliferating cells to obtain rich nourishment; absorption can take place readily, and the part regains its normal condition entirely. On the other hand, a bruise at the heel or at the withers finds a dense, inextensible tissue where the multiplying elements and exuded fluids choke up all communication, and the parts die (necrose) from want of blood and cause a serious quittor, or fistula.

This effect of structure of a part on the same process shows the importance of a perfect knowledge in the study of a local trouble and the indispensable part that such knowledge plays in judging the gravity of an inflammatory disease and in formulating a prognosis or opinion of the final termination of it. It is this that allows the veterinarian, through his knowledge of the intimate structure of a part and the relations of its elements, to judge the severity of a disease and to prescribe different modes of treatment in two animals for troubles which, to the less-experienced observer, appear to be absolutely identical.

Termination of inflammation.—Like congestion, inflammation may terminate by resolution. In this case the exuded lymph undergoes chemical change, and the products are absorbed and carried off by the blood vessels and lymphatics to be thrown out of the body by the kidneys, liver, the glands of the skin, and the other excretory organs. The cells that have wandered into the neighboring tissues from the blood vessels gradually disappear or become transformed into fixed cells. Those that are the result of the tissue cells, wakened into active life, follow the same course. The vessels themselves contract, and, having resumed their normal caliber, the part apparently re-assumes its normal condition. It is always weakened, however, and a new inflammation is more likely to reappear in a previously inflamed part than in a sound one. The alternate termination is necrosis or death of a part. If the necrosis is gradual, by small stages, each cell losing its vitality after the other in more or less rapid succession, it is called ulceration. If it occurs in a considerable part at once, it is called gangrene. If this death of the tissues occurs deep in the organism and the destroyed elements and proliferated and dead cells are enclosed in a cavity, the result is an abscess. When it occurs on a surface, it is an ulcer, and an abscess by breaking on the exterior becomes then also an ulcer. Proliferating and dying cells and the fluid that exudes from an ulcerating surface and the debris of broken-down tissue are known as pus, and the process by which this is formed is known as suppuration. A mass of dead tissue in a soft part is termed a slough; the same in bone is called a sequestrum. Such changes are especially likely to occur when the part becomes infected with micro-organisms that have the property of destroying tissue and thus caus-

ing the production of pus. These are known as pyogenic micro-organisms. There are also bacilli capable of multiplying in tissues and so irritating them as to cause them to die (necrose) without forming pus.

Treatment of inflammation.—The study of the causes and pathological alterations of inflammation has shown the process to be one of hypernutrition, attended by excessive blood supply, so this study will indicate the primary factor to be employed in the treatment of it. Any agent that will reduce the blood supply and prevent the excessive nutrition of the elements of the part will serve as a remedy. The means employed may be used locally to the part, or they may be constitutional remedies, which act indirectly.

Local treatment.—Removal of the cause frequently allows the part to heal at once. Among causes of inflammation are a stone in the frog, causing a traumatic thrush; a badly fitting harness or saddle, causing ulcers of the skin; decomposing manure and urine in a stable, which, by their vapors, irritate the air tubes and lungs and cause a cough.

Motion stimulates the action of the blood and thus feeds an inflamed tissue. This is alike applicable to a diseased point irritated by movement, an inflamed pair of lungs surcharged with blood by the use demanded of them in a working animal, an inflamed eye exposed to light, or an inflamed stomach and intestines still further fatigued by feed. Rest, absolute quiet, a dark stable, and small quantities of easily digested feed will often cure serious inflammatory troubles without further treatment.

The application of ice bags or cold water by bandages, douching with a hose, or irrigation with dripping water contracts the blood vessels, acts as a sedative to the nerves, and lessens the vitality of a part; it consequently prevents the tissue change that inflammation produces.

Either dry or moist heat quickens the circulation and renders the chemical changes more active in the surrounding parts; it softens the tissues and attracts the current of blood from the inflamed organ; it also promotes the absorption of the effusion and hastens the elimination of the waste products in the part. Heat may be induced by hand rubbing, active friction and the application of warm coverings (bandages), cloths wrung out of warm water, or by steaming with warm, moist vapor, medicated or not. All such methods will answer the same purpose. The steaming with vapor is especially applicable to inflammatory troubles in the air passages.

Counterirritants are used for deep inflammations. They act by bringing the blood to the surface and consequently lessening the blood pressure within. The bringing of the blood to the surface diminishes the amount in the internal organs and often rapidly relieves a congested

lung or liver. The most common counterirritant is mustard flour. It is applied as a soft paste mixed with warm water to the under surface of the belly and to the sides, where the skin is comparatively soft and vascular. For colds in the throat or inflammations at any point, treatment should be applied in the same manner. Blisters, iodine, and many other irritants are used in a similar way.

Treatment.—Treatment for inflammation is designed to reduce the current of blood, which is the fuel for the inflammation in the diseased part; to quiet the patient; to combat the fever or general effects of the trouble in the system; and to favor the neutralization or elimination of the products of the inflammation.

Reducing the quantity of blood lessens the amount of pressure on the vessels and, as a sequel, the volume that is carried to the point of inflammation; it lowers the body temperature or fever; it numbs the nervous system, which plays an important part as a conductor of irritation in diseases.

Reduction of blood is obtained in various ways.

Cathartics act by drawing off a large quantity of fluid from the blood through the intestines, removing only the watery and not the formed elements from the circulation. The blood cells remain, leaving the blood as rich as it was before. Again, the glands of the intestines are stimulated to excrete much waste matter and other deleterious material that may be acting as a poison in the blood.

Diuretics operate through the kidneys in the same way.

Diaphoretics aid depletion of the blood by pouring water in the form of sweat from the surface of the skin and stimulating the discharge of waste material out of its glands.

Antipyretics are remedies to reduce the temperature. This may be accomplished by depressing the center in the brain that controls heat production. Some coal-tar products are very effective in this way, but they have the disadvantage of depressing the heart, which should always be kept as strong as possible. If they are used it may be desirable to give heart tonics or stimulants with them. The temperature of the body may be lowered by cold packs or by showering with cold water. This is a useful procedure in many diseases.

Depressants slow or weaken the action of the heart and reduce the quantity and force of the current of the blood that is carried to the point of local disease; they lessen the vitality of the animal and for this reason are now used much less than formerly.

Anodynes quiet the nervous system. Pain in the horse, as in man, is one of the important factors in the production of fever, and the dulling of pain often prevents, or at least reduces, the fever. Anodynes produce sleep, thereby resting the patient and allowing recuperation for the succeeding struggle of the vitality of the animal against the exhausting drain of the disease.

The diet of an animal suffering from acute inflammation is of the greatest importance. An overloaded circulation can be starved to a reduced quantity and to a less rich quality of blood by reducing the quantity of feed given to the patient. Feeds of easy digestion do not tire the already fatigued organs of an animal with a torpid digestive system. Nourishment in the form of slops and cooling drinks will be taken by a suffering animal when it would be refused if offered in its ordinary form, as hard oats or dry hay, requiring the labor of grinding between the teeth and swallowing by the weakened muscles of the jaws and throat.

Selected tonics and stimulants are used to meet special conditions, as in the case of a feeble heart, and the aftertreatment of inflammatory troubles as well as acute stages of them. They help to brace up weakened and torpid glands; they stimulate the secretion of the necessary fluids of the body and tend to hasten the excretion of the waste material produced by the inflammatory process; they regulate the action of a weakened heart and aid the chemical changes needed for returning the altered tissues to their normal condition.

FEVER

The term "fever" is erroneously regarded by many persons as being a disease in itself rather than merely a group of symptoms developing during the course of a true disease. In fever the chief manifestation is a rise in body temperature, but strictly speaking fever is more than an elevation of temperature. Often at the onset of a febrile reaction there are: A chill with marked shivering, erection of the hairs, rapid pulse and respiration, and a generally apprehensive attitude. Later the skin becomes harsh and dry, the coat staring, the urine scanty and often highly colored. Constipation is common and there are varying degrees of depression. These febrile symptoms accompany many of the infectious diseases as well as certain forms of intoxication. The disturbances, together referred to as fever, are believed to develop as a result of the accumulation of toxic products that are formed during the disease. The functional activities of the various organs of the body are interfered with, causing either excessive activity or incapacity to carry out their allotted tasks. Whether through increased heat formation or failure to dissipate the body heat properly, there may be an elevation of temperature to 107° F. or even higher in rare instances. It is this rise in temperature that the layman often attempts to treat, failing to recognize the underlying cause of the condition. In fact, it is believed by some that the increased temperature is an evidence that the animal body is combating the disease. The disease itself must be treated rather than the group of symptoms that have been described as fever.

Methods of Administering Medicines

By CH. B. MICHENER, V. S.

[Revised by HUBERT BUNYEA, A. B., D. V. M.]

Medicine may enter the body through the mouth, air passages, skin, tissue beneath the skin (hypodermic methods), rectum, genito-urinary passages, and blood (intravenous injections).

By the mouth.—Medicines can be given by the mouth in the form of solids, as powders or pills; liquids, and pastes, or electuaries.

Solids administered as powders should be as finely pulverized as possible to obtain rapid solution and absorption. Their action is in this way facilitated and intensified. Powders must be free from any irritant or caustic action on the mouth. Those that are without any disagreeable taste or smell are readily eaten with the feed or taken in the drinking water. When given with the feed they should first be dissolved or suspended in water and thus sprinkled on the feed. If they are dry, the horse will often leave the medicine in the bottom of the manger. Nonirritant powders may be given in capsules, as balls are given.

Pills, or "balls," when properly made, are cylindrical in shape, 2 inches in length, and about $\frac{3}{4}$ inch in diameter. They should be fresh, but if it is necessary to keep them for some time they should be made up with glycerin or some such agent to prevent their becoming too hard. Very old, hard balls are sometimes passed whole with the manure without being acted on at all. Paper is sometimes wrapped around balls when given, if they are so sticky as to adhere to the fingers or the balling gun. Paper used for this purpose should be thin but firm, such as the tougher tissue papers. Balls are preferred to drenches when the medicine is extremely disagreeable or nauseating, when the dose is not too large, when the horse is difficult to drench, or when the medicine is intended to act slowly. Certain medicines cannot or should not be made into balls—for example, medicines that must be given in large doses, oils, caustic substances unless in small dose and diluted and thoroughly mixed with the vehicle, deliquescent or efflorescent salts. Substances suitable for balls can be made up by the addition of honey, sirup, or similar substance, when re-

quired for immediate use. Gelatin capsules of different sizes are now obtainable and are a convenient means of giving medicines in ball form.

When balls are to be given the following directions should be observed: In shape they should be cylindrical, of the size mentioned, and soft enough to be easily compressed by the fingers. If made round or egg shaped, if too long or too hard, they are likely to become fixed in the gullet and cause choking. Balls may be given with the balling gun (obtainable at any surgical supply house) or by hand. If given by hand a mouth speculum or gag may be used to prevent the animal from biting the hand or crushing the ball. Always loosen the horse before attempting to give a ball; if tied he may break his halter and injure himself or the one giving the ball. With a little practice it is much easier to give a ball without the mouth gag, as the horse always fights more or less against having his mouth forced open. The tongue must be firmly grasped with the left hand and gently pulled forward; the ball, slightly moistened, is then placed with the tips of the fingers of the right hand as far back into the mouth as possible; as the tongue is loosened it is drawn back into the mouth and carries the ball backward with it. The mouth should be kept closed for a minute or two. It is advisable to have a pail of water at hand so that the horse can drink after balling. This precaution will often prevent the animal from coughing out the ball or its becoming lodged in the gullet.

Pastes or electuaries are medicines mixed with licorice-root powder, ground flaxseed, molasses, or sirup to the consistence of honey, or a "soft solid." They are intended, chiefly, to act locally on the mouth and throat. They are given by being spread upon the tongue, gums, or teeth with a wooden paddle or strong, long-handled spoon.

Medicines by the mouth are mostly given in the form of liquids, since it is often impossible to get balls properly made or to induce owners or attendants to attempt to give them. Liquids may be given as drenches when the dose is large, or when but a small quantity is administered it may be injected into the mouth with a hard-rubber syringe or be poured on the tongue from a small vial.

When medicine is to be given as a drench, one must be careful to use water or oil enough to dissolve or dilute it thoroughly; more than this makes the drench bulky and is unnecessary. Insoluble medicines, if not irritant or caustic, may be given simply suspended in water, if the bottle is shaken well immediately before giving the drench. The bottle used for drenching purposes should be clean, strong, and smooth about its neck; it should be without shoulders, tapering, and of a size to suit the quantity to be given. A horn or tin bottle may be better, because it is not so apt to be broken by the teeth. If the dose is small, the horse's head may be held up by the left hand, while the medicine is poured into the mouth by the right. The left thumb should be placed in the angle of the lower jaw and the fingers spread

out in such manner as to support the lower lip. Should the dose be large, the horse difficult to handle, or the attendant unable to support the head as directed, the head should then be held up mechanically. One method is by fastening a long-handled wooden fork under the noseband of the halter strap; or a rope may be fastened to the noseband and thrown over a limb, beam, or through a pulley suspended from the ceiling. Another way of supporting the head is to place a loop in the end of a rope, and place this loop in the mouth just behind the upper front teeth or tusks of the upper jaw, and run the free end through a pulley, as described, and held by an assistant. It should never be fastened, as the horse in that case might seriously injure itself. The head should be elevated just enough to prevent the horse from throwing the liquid out of its mouth. The line of the face should be horizontal or only a little higher. If the head is drawn too high the animal cannot swallow with ease or even with safety. The person giving the drench should stand on some object in order to reach the horse's mouth—on a level, or a little above it. The bottle or horn should then be introduced at the side of the mouth, in front of the molar teeth, in an upward direction. This will cause the horse to open its mouth, then the base of the bottle should be elevated and about 4 ounces of the liquid allowed to escape on the tongue as far back as possible, care being taken not to get the neck of the bottle between the back teeth. The bottle is then removed, and if the horse does not swallow, the fingers or neck of the bottle should be rubbed against the roof of the mouth, and occasionally removed. As soon as the animal swallows, repeat the operation until all the drench has been taken. If coughing occurs, or if by any mishap, the bottle should be crushed in the mouth, lower the head immediately.

Do not rub, pinch, or pound the throat nor draw out the tongue when giving a drench. These processes in no way aid the horse to swallow and often do more harm than good. *Drenches must never be given through the nose.* Large quantities of medicine given by pouring into the nose are likely to strangle the animal, or, if the medicine is irritating, it is likely to set up an inflammation of the nose, fauces, windpipe, and sometimes the lungs.

Drenching of the horse should not be attempted under certain conditions as to do so might be positively dangerous. Horses suffering from such diseases as encephalitis, strangles, purpura hemorrhagica, botulism, or any disease in which there is either soreness or paralysis of the throat should be given medication either by means of the stomach tube or by some route other than by mouth. This applies also to horses that are delirious or comatose. The stomach tube permits one to introduce drugs and other agents directly into the stomach, obviating the danger of choking or other untoward

results. The stomach tube is commonly passed by way of one nostril, back to the throat, thence down the gullet to the stomach. This operation requires considerable skill and experience, and should be done by a veterinarian.

By the air passages.—Medicines are administered to the lungs and upper air passages by insufflation, inhalation, injection, and nasal douche.

Insufflation consists in blowing an impalpable powder directly into the nose. It is rarely used in modern veterinary practice.

Gaseous and volatile medicines, as well as medicated steam or vapor, are given by inhalation. The animal or animals should be placed in a tight room, where these gases are generated until the atmosphere is sufficiently impregnated with them. Volatile medicines—as the anesthetics (ether, chloroform, etc.)—should be given by the attending surgeon only. Medicated vapors are administered by placing a bucket containing hot water, vinegar, and scalded hay or bran to which the medicines have been added, in the bottom of a long grain bag. The horse's nose is inserted into the top of the bag, and it thus inhales the "medicated steam." Care must be taken not to have it hot enough to scald the animal.

Injections are made into the trachea by means of a hypodermic syringe. This method of medication is used for treating local diseases of the trachea and upper bronchial tubes. If it is used, it should be done only by a veterinarian.

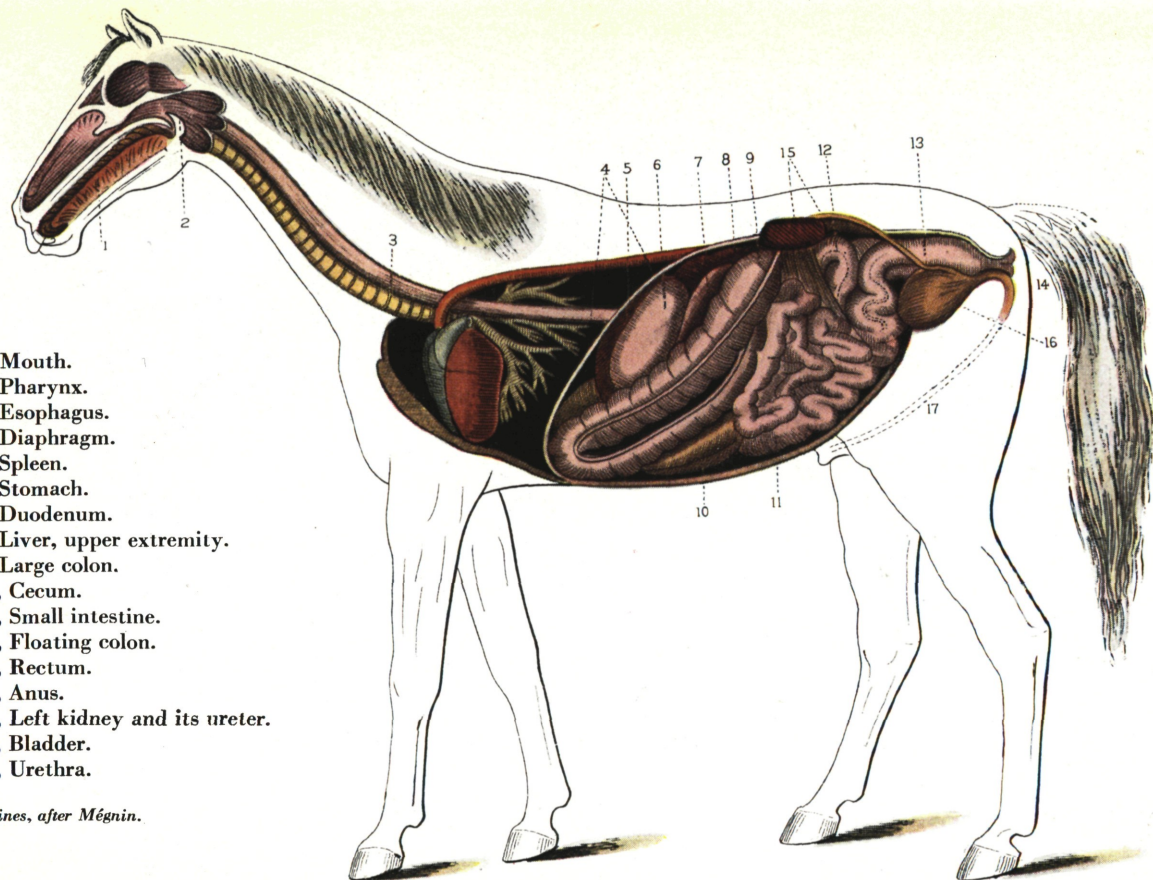
The nasal douche is used by the veterinarian in treating some local diseases of the nasal chambers. Special appliances and professional knowledge are necessary when using liquid medicines by this method. It is not often resorted to, even by veterinarians since, as a rule, the horse objects strongly to this mode of medication.

By the skin.—Medicines are often administered by the skin, yet care must be taken in applying some medicines—such as tobacco water, carbolic acid solutions, strong creolin solutions, mercurial ointment—over the entire body, as poisoning and death follow in some instances from absorption through the skin. Poisonous medicines must not be applied over very large raw or abraded surfaces. With domestic animals medicines are applied to the skin only to allay local pain or cure local disease.

By the tissue beneath the skin (hypodermic method).—Medicines are frequently given by the hypodermic syringe under the skin. It is not safe for anyone except medical or veterinary practitioners to use this form of medication. Many precautions should be observed, and a knowledge of anatomy is of value. One of the chief precautions is the sterilization of the syringe and point of injection, otherwise an abscess may be produced.

- 1, Mouth.
- 2, Pharynx.
- 3, Esophagus.
- 4, Diaphragm.
- 5, Spleen.
- 6, Stomach.
- 7, Duodenum.
- 8, Liver, upper extremity.
- 9, Large colon.
- 10, Cecum.
- 11, Small intestine.
- 12, Floating colon.
- 13, Rectum.
- 14, Anus.
- 15, Left kidney and its ureter.
- 16, Bladder.
- 17, Urethra.

Haines, after Mégnin.



DIGESTIVE APPARATUS.

By the rectum.—Medicines may be given by the rectum when they cannot be given by the mouth, or when they are not retained in the stomach; when a local action on the large intestine is desirable; when it is desired to destroy the small worms infesting the large intestines or to stimulate peristaltic motion of the intestines and cause evacuation. In such cases medicines are given in the form of suppositories or as liquid injections (enemas). Foods also may be given in this way.

Suppositories are medicated conical bodies intended to be introduced into the rectum or vagina to allay irritation and pain of these parts. They are seldom used in treating horses.

Enemas, when given for absorption, should be small in quantity, neutral or slightly acid in reaction, and 90° to 100° F. in temperature. These, like feeds given by the rectum, should be introduced only after the large intestine has been emptied by the hand or by copious injections of tepid water. Enemas, or clysters, if to aid the action of physics, should be in quantities sufficient to distend the bowel and cause the animal to eject them. Water, salt and water, or soap and water, in quantities of a gallon or more, may be given every half hour. It is best that the horse retain them for some time, as the liquid serves to moisten the dung and favors defalcation. Stimulating enemas, such as glycerin, should be administered after those treatments already mentioned have emptied the large intestines, with the purpose of still further increasing the natural motion of the intestines and aiding the purging medicine.

Liquids may be injected into the rectum by means of a large syringe or a pump. A very good "irrigator" can be purchased from any tinsmith at low cost and should be constantly at hand on every stock farm. It consists of a funnel about 6 inches deep and 7 inches in diameter, with a tube to which a piece of rubber hose, such as small garden hose, 4 feet long may be attached. The hose, well oiled, should be inserted gently into the rectum about 2 feet. The liquid may then be poured into the funnel and allowed to gravitate into the bowels.

Ordinary cold water or even ice-cold water is highly recommended by many as a rectal injection for horses overcome by the excessive heat of summer and may be given by this simple irrigator.

By the genitourinary passages.—This method of medication is especially useful in treating local diseases of the genitourinary organs. It finds its chief application in the injection and cleansing of the uterus and vagina. For this purpose a large syringe or the irrigator previously described may be used.

By the blood.—Injections directly into veins are to be made by medical or veterinary practitioners only.

Diseases of the Digestive Organs

By CH. B. MICHENER, V. S.

[Revised by JOHN R. MOHLER, A. M., V. M. D., D. Sc.]

FEED AND WATER IN RELATION TO DIGESTION

Although the horse is not so susceptible to digestive disturbances as some other farm animals, a general knowledge of various feeds that are used for horses and their effects on the digestive organs will aid the horse owner in maintaining the health of his animals. An important point to be considered is the digestibility of feeds, that is, the readiness with which they undergo those changes in the digestive tract that fit them for absorption and assimilation as parts of the animal body.

The age and health of the animal will, of course, modify the digestibility of feeds, as will also the manner and time of harvesting, preserving, and preparing.

In the horse, digestion takes place principally in the intestines, and here, as in all other animals and with all feeds, a certain part only of the feed is digested; another portion is undigested. This proportion of digested and undigested feed must claim passing notice at least, for if the horse receives too much feed, or bulky feed containing much indigestible waste, a large portion of it must pass out unused, entailing not only the loss of this unused feed, but also calling for an unnecessary expenditure of vital force on the part of the digestive organs of the horse. It is thus that too much feed may make an animal thin.

Feeds must be wholesome, clean, and sweet, the hours of feeding regular, the mode of preparation found by practical experience to be the best must be adhered to, and cleanliness in preparation and administration must be observed.

Above all things, avoid feeding musty or moldy feeds as they are frequent causes of disease. Lung trouble such as bronchitis and heaves may follow their use. The digestive organs may suffer from the use of musty or moldy feeds, and at times there may be accompanying symptoms of a severe brain disorder. Musty hay is generally considered to produce disorder of the kidneys, and the danger from feeding ergotized grasses or grains to pregnant animals is well known. In this country horses are fed chiefly hay, grass, corn fodder, roots, oats, corn, wheat, and rye.

The length of time occupied by stomach digestion in the horse varies with the different feeds. Hay and straw pass out of the stomach more

rapidly than oats. Oats, then, should be given after hay, for if reversed the hay would cause the oats to be sent onward into the intestines before being fully acted upon by the stomach and as a result produce indigestion. There is another good reason why hay should be given first, particularly if the horse is very hungry or if exhausted from overwork, namely, it requires more time in mastication (insuring proper admixture of saliva) and cannot be bolted, as can grains. In either instance water must not be given soon after feeding, as it washes the feed from the stomach before it is fitted for intestinal digestion.

The stomach begins to empty itself soon after the commencement of feeding and continues rapidly while the animal is eating. Afterward the passage is slower, and several hours are required for the stomach to be entirely empty. The nature of the work required of the horse must be used as a guide in the selection of its feed. Rapid or severe labor cannot be performed on a full stomach. For such labor feed must be given in small quantity and about 2 hours before the horse is put to work. Even horses intended for slow work must never be engorged with bulky, innutritious feed immediately before they are put to work. Since the stomach of the horse is small, this animal should be fed often and in small quantities.

The horse should always be watered before being fed. One of the common errors of feeding, and the one that produces more digestive disorders than any other, is to feed too soon after a hard day's work. This must never be done. If a horse is completely jaded, it will be beneficial to give only a few swallows of water until after the animal has cooled off. After a short rest a small quantity of hay may be given, but the grain should be withheld for 1 or 2 hours. These same remarks will apply with equal force to the horse that for any reason has been fasting for a long time. After a fast, feed less than the horse would eat, for if allowed too much the stomach becomes engorged, its walls paralyzed, and colic is almost sure to follow. The horse should be fed three or four times a day. It will not do to feed concentrates entirely. Bulky feed must be given to detain the grains in their passage through the intestinal tract; bulk also favors distention and thus mechanically aids absorption. For horses that do slow work the greater part of the time, chopped or cut hay fed with crushed oats, ground corn, or similar grains, is the best manner of feeding, as it gives the required bulk, and saves time and half the labor of feeding.

Sudden changes of diet are always dangerous. When desirous of changing, do so very gradually. If a horse is accustomed to oats, a sudden change to a full meal of corn will almost always sicken the animal. Increasing the quantity of the usual feed also must be done gradually. The quantity of feed given must always be in proportion to the amount of labor to be performed. If a horse is to do a small

amount of work, or rest entirely from work for a few days, he should receive a proportionately decreased quantity of feed. If this should be observed even on Saturday night and Sunday, there would be fewer ailments that often occur on Monday morning, such as colics and lymphangitis.

Feeds should also be of a more laxative nature when the horse is to stand for several days.

KINDS OF FEED

Hay.—The best hay for horses is timothy. It should be about 1 year old, of a greenish color, crisp, clean, fresh, and possessing a sweet, pleasant aroma. Even this good hay, if kept too long, loses part of its nourishment, particularly the vitamins and, although it may not be positively injurious, it is hard, dry, and indigestible. New hay is difficult to digest, produces much salivation (slobbering), and occasional purging and irritation of the skin. If fed at all it should be mixed with old hay.

The second crop, or aftermath, is not considered good hay for horses but is prized by some farmers as good for milk cows, the claim being made that it increases the flow of milk. The value of hay depends on the time of cutting as well as care in curing. Hay should be cut when in full flower but before the seeds fall; if left longer it becomes dry, woody, and less nutritive. When the crop is cut it should remain in the field as short a time as possible. If left too long in the sun it loses color and flavor and wastes. It is impossible to state any fixed time that hay must have to cure, as this depends on the weather, thickness of the crop, and many other circumstances; but it is well known that in order to preserve the color and aroma of hay it should be turned, or tedded, frequently and cured as quickly as possible. On the other hand, hay spoils in the mow if harvested too green or when not sufficiently dried. Mowburnt hay produces disorder of the kidneys and bowels and causes the horse to fall off in condition.

The average horse on grain should be allowed 10 to 12 pounds of good hay a day. It is a mistake to think that horses at light work can be kept entirely on hay. Such horses soon become potbellied, fall off in flesh, and do not thrive. The same is true of colts; unless the latter are fed some grain they grow into long, lean, gawky creatures and never make so good horses as those accustomed to grain with hay.

Straw.—Straw is not extensively fed in this country, and when used it should be cut and mixed with hay and ground or crushed grain. Wheat, rye, and oat straw are most used; of these, oat straw is most easily digested and contains the most nourishment. Pea and bean straw are occasionally fed to horses, the pea being preferable, according to most authorities.

Chaff.—Wheat and rye chaff should never be used as a feed for horses. The beards frequently become lodged in the mouth or throat and produce more or less serious trouble. In the stomach and intestines they often serve as the nucleus of the soft concretions, which are described in the section on obstructions of the digestive tract.

Oat chaff, if fed in small quantities and mixed with cut hay or corn fodder, is relished by horses. It should not be given in large quantities, as a troublesome and sometimes fatal diarrhea often follows the practice of allowing horses or cattle free access to a pile of oat chaff.

Oats.—Oats take precedence over all grains as a feed for horses, as the ingredients necessary for the complete nutrition of the body exist in them in the best proportions. Oats are, besides, more easily digested, and a larger proportion is absorbed and converted into the various tissues of the body. Care must be taken in selecting oats. According to Stewart, the best oats are 1 year old, plump, short, hard clean, bright, and sweet. New oats are indigestible. Kiln-dried oats should not be used, as a rule, for even though originally good this drying process injures them. Oats that have sprouted or fermented are injurious and should never be fed. Oats are to be given either whole or crushed—whole in most instances; crushed to old horses and those having defective teeth. Horses that bolt their feed are also best fed crushed oats and out of a manger large enough to permit spreading the grain in a thin layer.

In addition to the allowance of hay above mentioned, the average horse requires about 12 quarts of good oats daily. The best oats are those cut about 1 week before they are fully ripe. Not only is the grain richer in nutritive materials at this time, but there is also less waste from scattering than if left to become dead ripe. Moldy oats, like hay and straw, may produce serious digestive disorders with accompanying symptoms of a disorder of the brain.

Wheat and rye.—These grains should be used for horses only in small quantities, bruised or crushed, and fed mixed with other grains or hay. If fed alone, in any considerable quantities, they are almost certain to produce digestive disorders, laminitis (founder), and similar troubles. They should never constitute more than one-fourth the grain allowance and should always be ground or crushed.

Bran.—The bran of wheat is the one most used, and its value as a feeding stuff is variously estimated. It should not be given alone but may be fed with other grains. It serves to keep the bowels open. Sour bran should not be given, for it disorders the stomach and intestines and may even produce serious results.

Corn.—This grain is not suitable as an exclusive feed for young horses as it is deficient in salts. It is fed whole or ground. Corn on

the cob is commonly used for horses affected with lampas. If the corn is old and is to be fed in this manner it should be soaked in pure, clean water for 10 to 12 hours. Corn is better given ground and fed in quantities of 1 to 2 quarts at a meal, mixed with crushed oats or wheat bran. Great care should be taken in giving corn to a horse that is not accustomed to it. It must be commenced in small quantities and gradually increased. If these directions are not observed in the feeding of corn, it is likely to produce acute indigestion.

Linseed.—Ground linseed is occasionally fed with other feeds to keep the bowels open and to improve the condition of the skin. It is of particular service during convalescence, when the bowels are sluggish in their action. Linseed tea is often given in irritable or inflamed conditions of the digestive organs.

Potatoes.—These are used as an article of feed for horses in many sections. If fed raw and in large quantities they often produce indigestion. Their digestibility is increased by steaming or boiling. They possess, in common with other roots, slight laxative properties.

Beets.—These are not much used as feed for horses.

Carrots.—These make an excellent feed, particularly during sickness. They improve the appetite and slightly increase the action of the bowels and kidneys. They possess also certain alterative properties, making the coat smooth and glossy. The roots may be considered, then, as an addition to the regular diet, and if fed in small quantities are highly beneficial.

Grasses.—Grass is the natural feed of horses. The term commonly applies to a great variety of plants, differing widely as to the amount of nourishment contained, some being almost entirely without value and eaten only when nothing else is obtainable, and others being positively injurious or even poisonous. None of the grasses are sufficient to keep the horse in condition for work. Horses thus fed are soft, sweat easily, purge, and soon tire on the road or when at hard work. Grass is indispensable to growing stock, and there is little or no doubt that it acts as an alterative when given to horses accustomed to grain and hay. It must be given to such horses in small quantities at first. The stomach and intestines undergo rest, and recuperate if the horse is turned on grass for a time each year. During febrile diseases grass acts almost as a medicine, lessening the fever and favoring recovery. Wounds heal more rapidly than when the horse is on grain, and some chronic disorders (chronic cough, for instance) disappear entirely when the animal is on grass. It is the experience of some persons that grass does more good when the horse crops it than when it is cut and fed. This may be due to the sense of freedom the animal enjoys on pasture, to the rest to his feet and legs, and for many other similar

reasons. When cut for him it should be fed fresh or only slightly wilted.

Silage.—Silage should not be considered as one of the principal roughages for horses. Its use is as a succulent, an appetizer, and tonic to be fed in limited quantities as a supplement to the regular ration. When used, this feed must be introduced gradually into the ration. It is a dangerous practice to feed molded or frozen silage to horses. Corn silage is the only kind that has met with any degree of favor as a horse feed. It has a valuable place in the winter ration if fed with care. The amount should not exceed 10 pounds daily per animal.

PREPARATION OF FEEDS

Feed is prepared for any of the following reasons: To make it more easily eaten, to make it more digestible, to economize in quantity, to give it some new property, and to preserve it. Reference has already been made to preparation by drying, which serves to preserve feeds. Drying, however, changes some of the properties of feed, that is, it removes the laxative tendency of most of them.

The grains are more easily eaten when ground, crushed, or even boiled. Rye or wheat should never be given whole, and even corn has less waste when ground, and, in common with all other grains, it is more easily digested than when fed whole.

Hay and fodder are economized when cut in short pieces. Not only will the horse eat the necessary quantity in a shorter time, but also there is less waste, and the mastication of the grains (whole or crushed) fed with them is insured.

Reference has already been made to those horses that bolt their feed; the consequences of such ravenous eating may be prevented if the grains are fed with cut hay, straw, or fodder. Long or uncut hay should also be fed, even though a certain quantity of hay or straw is cut and fed mixed with grain.

One objection to feeding cut hay mixed with ground or crushed grains, and wet, must not be overlooked during the hot months. Such feed is likely to undergo fermentation if not fed directly after it is mixed; even the mixing trough, unless frequently scalded and cleaned, becomes sour and enough of its scrapings are taken in with the feed to produce flatulent (wind) colic. A small quantity of salt should always be mixed with such feed. Bad feeds are expensive at any price and should never be fed.

The advantage of boiling roots has been mentioned. Not only does this make them less likely to produce digestive disorders, but it also makes them clean. Boiling or steaming grains is recommended when the teeth are poor or when the digestive organs are weak.

WATER

When horses have access to water continually they never drink to excess. A horse requires a daily average of about 8 gallons of water. The quantity varies not only with the weather and degree of activity of the horse, but also somewhat with the character of the feed. With green feed less water will be needed than with dry hay and grain. At rest, the horse should receive water at least three times a day; when at work, more frequently. The rule should be to give it in small quantities and often. There is a popular fallacy that if a horse is warm it should not be allowed to drink, many asserting that the first swallow of water founders the animal or produces colic. This is erroneous. No matter how warm a horse may be, it is always safe to allow the animal 6 to 10 swallows of water. If this is given on going into the stable, the horse should have at once a pound or two of hay and be allowed to rest about an hour before feeding. If water is now offered it will in many cases be refused, or at least the animal will drink sparingly. The danger, then, is not in the first swallow of water but in the excessive quantity that the animal will take when warm if it is not restrained.

Ice-cold water should never be given to horses. It may not be necessary to add hot water, but the water troughs should be in such a position that the sun may shine upon the water during the winter mornings. Water, even though it is cold, seldom produces serious trouble if the horse has not been deprived of it for too long a time.

Water that is impure from the presence of decomposing organic matter, such as is found in wells and ponds in close proximity to manure heaps and cesspools, is frequently the cause of diarrhea, dysentery, and many other diseases of stock, and water that is impregnated with different poisons and contaminated in many instances with specific media of contagion is likely to cause death. Water should be free also from such inorganic impurities as the salts of metals and from such compounds as lime, which may cause intestinal concretions.

DISEASES OF THE TEETH

DENTITION

This covers the period during which the young horse is cutting its teeth—from birth to the age of 5 years. With the horse more difficulty is experienced in cutting the second, or permanent, teeth than in cutting the first, or milk, teeth. There is a tendency among farmers and many veterinarians to pay too little attention to the teeth of young horses. Percivall relates an instance illustrative of this that is best told in his own words:

I was requested to give my opinion concerning a horse, then in his fifth year, which had fed so sparingly for the last fortnight, and so rapidly declined in con-

dition in consequence, that his owner, a veterinary surgeon, was under no light apprehensions about his life. He had himself examined his mouth without having discovered any defect or disease, though another veterinary surgeon was of opinion that the difficulty or inability manifested in mastication, and the consequent cudding, arose from preternatural bluntness of the surfaces of the molar teeth, which were, in consequence, filed, but without beneficial result. It was after this that I saw the horse, and I confess I was, at my first examination, quite as much at a loss to offer any satisfactory interpretation as others had been. While meditating, however, after my inspection, on the apparently extraordinary nature of the case, it struck me that I had not seen the tusks. I went back into the stable and discovered two little tumors, red and hard, in the situation of the inferior tusks, which, when pressed, gave the animal insufferable pain. I instantly took out my pocketknife and made crucial incisions through them both, down to the coming teeth, from which moment the horse recovered his appetite and, by degrees, his wonted condition.

The mouths of young horses should be examined from time to time to see whether one or more of the milk teeth are not remaining too long, causing the second teeth to grow in crooked, in which case the first teeth should be removed with the forceps.

IRREGULARITIES OF TEETH

It is customary, especially in large cities, to have horses' teeth regularly "floated," or "rasped," by "veterinary dentists." In some instances this is very beneficial, but in most cases it is entirely unnecessary. Because of the character of the feed, the rubbing, or grinding, surface of the horse's teeth should be rough. Yet the upper jaw is somewhat wider than the lower, and owing to the fact that the teeth in the two jaws are not exactly opposite each other, a sharp ridge is left unworn on the inside of the lower molars and on the outside of the upper, which may excoriate the tongue or cheeks to a considerable extent. This condition may readily be felt by the hand, and these sharp ridges when found should be rasped down by a guarded rasp. In some instances the first or last molar tooth is unnaturally long, owing to the fact that the one in the opposite jaw has been lost or does not close perfectly against it. Should it be the last molar that is thus elongated, it will require the aid of the veterinary surgeon, who has the necessary forceps or chisel for cutting it. The front molar may be rasped down if much care is taken. It is common to find the tooth corresponding to a decayed one in the opposite jaw very much elongated, sometimes to such an extent that the mouth cannot be perfectly closed. Such teeth must also be shortened by the tooth forceps, chisel, tooth saw, or rasp. In all instances in which horses quid their feed, if they are slobbering, or evince pain in mastication, shown by holding the head to one side while chewing, the teeth should be carefully examined. Horses whose teeth have unduly sharp edges are likely to drive badly; they pull to one side, do not bear on the bit, or bear on too hard, toss the head, and start suddenly when a tender

spot is touched. If, as is usually the case, all the symptoms indicate the presence of sharp corners or projections, these must be removed by the rasp. If decayed teeth are found or other serious difficulty detected, or if the cause of the annoying symptoms is not discovered, a veterinarian should be called.

TOOTHACHE

This is rare in the horse and is mostly witnessed when there is decay of a tooth or inflammation about its root. Toothache can be discovered in the horse by the pain shown while feeding or drinking cold water. Horses so affected will sometimes stop chewing suddenly, throw the head to one side, and slightly open the mouth. They behave as though some sharp body had punctured the mouth. If on examination no foreign body is found, each tooth should be carefully examined. If this cannot be done with the hand in the mouth, in most instances, the aching tooth can be discovered by pressing each tooth from without. By tapping the teeth in succession with a hard object, such as a small hammer, the one that is tender may be identified. The horse will flinch when the sore tooth is pressed or tapped upon. In most cases the only thing to be done is to extract the decayed tooth, and this, of course, is to be attempted by the veterinarian only.

DEFORMITY

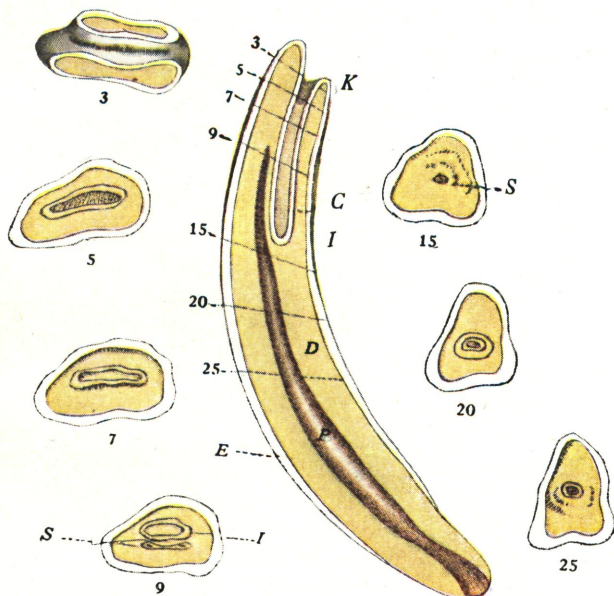
There is a deformity, known as parrot mouth, that interferes with prehension, mastication, and, indirectly, with digestion. The upper incisors project in front of and beyond the lower ones. The teeth of both jaws become unusually long, as they are not worn down by friction. Such horses experience much difficulty in grazing. Little can be done except to examine the teeth occasionally, and if those of the lower jaw become so long that they bruise the bars of the upper jaw, they must be shortened by the rasp or saw. Horses with this deformity should not be forced to subsist entirely on pasture.

The method of determining the age of a horse by the teeth is illustrated in plate IV.

DISEASES OF THE MOUTH

LAMPAS

Lampas is the name given to a swelling of the mucous membrane covering the hard palate and projecting in a more or less prominent ridge immediately behind the upper incisors. The hard palate is composed of spongy tissue that fills with blood when the horse is feeding. This tissue causes the ridges to become prominent, and they then help to keep feed from dropping from the mouth. This swelling is entirely natural and occurs in every healthy horse.



AGE OF HORSES AS INDICATED BY TEETH.

Longitudinal section of left central lower incisor and cross sections of same tooth showing table surfaces as they appear at the ages of 3, 5, 7, 9, 15, 20, and 25 years. C, Cement; D, Dentine; E, Enamel; I, Infundibulum; K, Cup; P, Pulp cavity; S, Star.

If there is some irritation in the mouth, as in stomatitis or during teething, the prominence of the hard palate may persist, owing to the increased blood supply. In such cases the cause of the irritation should be sought for and removed. Burning the lampas is barbarous and injurious, and it should never be tolerated.

It is a common opinion among owners of horses and stablemen that lampas is a disease that frequently exists. In fact whenever a horse fails to eat and if it does not show marked symptoms of a severe illness, many of them say at once that the animal has the lampas. It is almost impossible to convince them to the contrary and in this respect it is an affliction of the stableman's imagination rather than of the horse's mouth.

STOMATITIS

Stomatitis is an inflammation of the mucous membrane lining the mouth and is produced by irritating medicines, feeds, or other substances. The symptoms are swelling of the mouth, which is also hot and painful to the touch; there is a copious discharge of saliva; the mucous membrane is reddened; and in some cases vesicles or ulcers in the mouth are observed. Treatment is simple, soft feed alone often being all that is necessary. A bucket of fresh, cold water should be kept constantly in the manger so that the horse may drink or rinse his mouth at will. In some instances, it may be advisable to use a wash of potassium chlorate, borax, or alum, about one-half ounce to a pint of water. Hay, straw, or oats should not be fed unless steamed or boiled. A form of contagious stomatitis, characterized by the formation within the mouth of small vesicles, or blisters, sometimes occurs. *See Vesicular Stomatitis under Infectious Diseases, p. 537.*

GLOSSITIS (INFLAMMATION OF THE TONGUE)

Glossitis, or inflammation of the tongue, is similar to stomatitis and mostly exists with it and is due to the same causes. Injuries to the tongue may produce this simple inflammation of its covering membrane, or, if severe, may produce lesions much more extensive, such as lacerations and abscesses. These latter would require surgical treatment, but for the simpler forms of inflammation of the tongue the treatment recommended for stomatitis should be followed.

SALIVATION (PTYALISM)

Salivation, or ptyalism, consists in an abnormal and excessive secretion of saliva. This is often seen as a symptom of irregular teeth, inflammation of the mouth or tongue, or of the use of such medicines as lobelia, mercury, and many others. Some feeds, such as clover, and particularly the second crop, produce it; foreign bodies, such as

nails, wheat chaff, and corncocks becoming lodged in the mouth also are causes. If the cause is removed no further attention is necessary, as a rule. Astringent washes may be applied to the mouth as a gargle or by means of a sponge.

PHARYNGITIS

Pharyngitis is an inflammation of the mucous membrane lining of the pharynx or throat. It rarely exists unless accompanied with stomatitis or laryngitis, especially the latter. In those rare instances in which the inflammation is mostly confined to the pharynx, febrile symptoms are noticed—difficulty of swallowing either liquids or solids; there is little cough except when the animal tries to swallow; there is no soreness on pressure over the larynx (head of the windpipe). Increased flow of saliva, difficulty of swallowing liquids in particular, and cough only when attempting to swallow are the symptoms best marked in pharyngitis. In some cases the throat becomes gangrenous and the disease ends in death.

Treatment.—A wet sheet should be wrapped around the throat and covered with rubber sheeting and a warm blanket. This should be changed three times daily; or the region of the throat may be rubbed with mercurial ointment twice daily until the skin becomes irritated, but not longer; potassium chlorate may be given in 2-dram doses four times daily, mixed with flaxseed meal or licorice-root powder and honey, as an electuary. Soft feeds should be given, and fresh water should be constantly before the horse.

PARALYSIS OF THE PHARYNX

Paralysis of the pharynx, or, as it is commonly called, paralysis of the throat, is a rare but very serious disease. The symptoms are as follows: The horse will constantly try to eat or drink but will be unable to do so; if water is offered from a pail the animal will apparently drink with avidity, but the quantity of water in the pail will remain about the same; if the horse can get any fluid into the back part of the mouth it will come out at once through the nose. Feeds also return through the nose or are dropped from the mouth, quidded. An examination of the mouth by inserting the hand does not demonstrate any obstruction or abnormal condition. These cases go from bad to worse; the horse constantly and rapidly loses condition, becomes very much emaciated, the eyes are hollow and lusterless, and death occurs from inanition.

Treatment is very unsatisfactory. A severe blister may be applied behind and under the jaw; the mouth should be frequently swabbed out with alum or potassium chlorate, 1 ounce to a pint of water, by means of a sponge fastened to the end of a stick. Appropriate nerve tonics may be administered by the veterinarian.

This disease may be mistaken at times for foreign bodies in the mouth, for encephalomyelitis, or for moldy corn poisoning, and botulism. It can be distinguished from the first mentioned, on a careful examination of the mouth, by the absence of any offending body, and by the flabby feel of the mouth, and from the last three affections by the animal's appearing to be in perfect health in every particular except this inability to eat or drink.

ABSCESSSES

Abscesses sometimes form back of the pharynx and give rise to symptoms resembling those of laryngitis or distemper. Interference with breathing that is of recent origin and progression, without any observable swelling or soreness about the throat, will make one suspect the formation of an abscess in this location. Little can be done in the way of treatment, except to hurry the ripening of the abscess and its discharge by steaming with hops, hay, or similar substances and by poulticing the throat. Opening an abscess in this region necessitates an intimate knowledge of the complex anatomy of the throat region and, therefore, is best done by a competent veterinarian.

DISEASES OF THE ESOPHAGUS, OR GULLET

It is rare to find diseases of this organ except as a result of the introduction of foreign bodies too large to pass or to the administering of irritating medicines. In the administration of irritant or caustic medicines great care should be taken that they are thoroughly diluted. If this is not done, erosions and ulcerations of the throat ensue, and this again is prone to be followed by constriction (narrowing) of the gullet.

CHOKING

Choking of the horse is common. It may occur when the animal is suddenly startled while eating apples or roots; consequently, one should be careful never to approach suddenly or put a dog after horses or cows that are feeding on such substances. If left alone these animals rarely attempt to swallow the object until it is sufficiently masticated.

Choking also arises from feeding oats in a deep, narrow manger to horses that eat greedily or bolt their feed. Wheat chaff is also a frequent cause of choke. This accident may result from attempts to force eggs down the throat without breaking them or from giving balls that are too large or not of the proper shape.

The object that causes the choking may lodge in the upper part of the esophagus, at its middle portion, or close to the stomach, giving rise to pharyngeal, cervical, or thoracic choke. In some

cases, when the original obstruction is low, all that part of the gullet above it is distended with feed.

Symptoms.—The symptoms vary somewhat according to the position of the body causing choke. In pharyngeal choke the object is lodged in the upper portion of the esophagus. The horse will show symptoms of great distress, hurried breathing, frequent cough, excessive flow of saliva, sweating, trembling, or stamping with the forefeet. The abdomen rapidly distends with gas. The diagnosis is completed by manipulating the upper part of the throat from without and by the introduction of the hand into the back part of the mouth, finding the body lodged here. In cervical choke (when the obstruction is situated at any point between the throatlatch and the shoulder) the protrusion caused by the object can be seen and the object can be felt. The symptoms here are not so severe; the horse occasionally draws itself up, arches the neck, and makes retching movements as though it wished to vomit. The abdomen may be tympanitic. Should there be any question as to the trouble, it may be found by pouring water into the throat from a bottle. If the obstruction is complete, by standing on the left side of the horse and watching the course of the esophagus, one can see the gullet, just above the windpipe, become distended with each bottle of water. This is not always a sure test, as the obstruction may be an angular body, in which case liquids would pass it. Solids taken would show in these cases; solids should not, however, be given as they serve to increase the trouble by rendering the removal of the body more difficult.

In thoracic choke the symptoms are less severe. Feed or water may be ejected through the nose or mouth after the animal has taken a few swallows. There will be some symptoms of distress, fullness of the abdomen, cough, and occasionally retching movements. Sometimes a choking horse emits groans. The facial expression always denotes great anxiety and the eyes are bloodshot. The diagnosis is complete if, on passing the probang (a flexible tube made for this purpose), an obstruction is encountered.

Treatment.—If the choke is at the beginning of the gullet (pharyngeal), an effort must be made to remove the obstacle through the mouth. A mouthgag, or speculum, should be introduced into the mouth to protect the hand and arm of the operator. Then, while an assistant, with his hands grasped tightly behind the object, presses it upward and forward with all his force, the operator must pass his hand into the mouth until he can seize the obstruction and draw it outward. This mode of procedure must not be abandoned with the first failure, as by continued efforts one may get the obstacle farther toward the mouth. If he fails with the hand, forceps may be introduced through the mouth and the object seized when it is just beyond the reach of the fingers.

Should the efforts entirely fail, the operator must then endeavor to force the obstruction downward by means of the probang. This instrument, which is of such signal service in removing choke in cattle, is decidedly more dangerous to use for horses; furthermore, a word of caution should be given regarding the use of such objects as whip-stalks and shovel handles. These are always dangerous, and more than one horse has been killed by such barbarous treatment.

In cervical as well as in thoracic choke, the first endeavor must be to soften or lubricate the obstruction by pouring oil or mucilaginous drinks down the gullet. After this has been done endeavor to move the object by gentle manipulations with the hands. If the animal is choked with oats or chaff (and these are the objects that most frequently produce choke in the horse), begin by gently squeezing the lower portion of the impacted mass and endeavor to work it loose a little at a time. This is greatly favored at times by the application of hot fomentations immediately about the obstruction. Persist in these efforts for at least an hour before deciding to resort to other and more dangerous modes of treatment. If unsuccessful, however, the probang may be used. In the absence of the regular instrument, a piece of 1-inch hose 6 feet long or a piece of new $\frac{3}{4}$ -inch manila rope well wrapped at the end with cotton twine and thoroughly greased with tallow may be used. The mouth is to be kept open by a gag of wood or iron and the head slightly raised and extended. The probang should then be carefully guided by the hand into the upper part of the gullet and gently forced downward until the obstruction is reached. Pressure must then be gradual and firm. At first too much force should not be used, or the esophagus will be ruptured. Firm, gentle pressure should be kept up until the object is felt to move, after which it should be followed rapidly to the stomach. If this mode of treatment is unsuccessful, the veterinarian can remove the object by cutting down upon it. This should not be attempted by a novice, as a knowledge of the anatomy of the parts is essential to avoid cutting the large artery, vein, and nerve that are closely related to the esophagus in its cervical portion.

STRICTURE OF THE ESOPHAGUS

This is due to corrosive medicines, previous choking (accompanied with lacerations, which, in healing, narrow the passage), or pressure on the gullet by tumors. In most cases of stricture, dilatation of the gullet in front of the constricted portion soon occurs. This dilatation is the result of the frequent accumulation of solid feed above the constriction. Little can be done in either of these instances except to give sloppy or liquid feed.

SACULAR DILATATION OF THE ESOPHAGUS

This follows choking and is due to stretching or rupture of the muscular coat of the gullet, allowing the internal, or mucous, coat to protrude through the lacerated muscular walls. Such a dilatation, or pouch, may gradually enlarge from the frequent imprisonment of feed. When liquids are taken, the solid materials are partially washed out of the pouch.

Symptoms.—The horse is able to swallow a few mouthfuls without apparent difficulty; then it will stop feeding, paw, contract the muscles of his neck, and eject a portion of the feed through the nose or mouth, or it will gradually work down to the stomach. As the dilatation thus empties itself the symptoms gradually subside, only to reappear when the animal has again taken solid feed. Liquids pass with but little inconvenience. Should this dilatation exist in the cervical region, surgical interference may sometimes prove effectual; if in the thoracic portion, nothing can be done, and the contents of the sac soon become too firm to be dislodged as heretofore, and the animal dies.

DISEASES OF THE STOMACH AND INTESTINES

As a rule it is difficult to distinguish between diseases of the stomach and of the intestines of the horse. The reason for this is that the stomach is relatively small. It lies away from the abdominal wall, and so pressure from without cannot be brought to bear upon it to reveal sensitiveness or pain. Nor does enlargement, or distention, of the stomach produce visible alteration in the form of the abdomen of the horse. Moreover, it is a rule to which there are few exceptions that an irritant or cause of disease of the stomach acts likewise on the intestines, so that it is customary to find them similarly deranged. For these reasons it is logical to discuss together the diseases of the stomach and intestines and to point out such localizations in one organ or another as are of importance in recognizing and treating the diseases of the digestive organs of the horse.

It should be understood that gastritis signifies an inflammation of the stomach and enteritis an inflammation of the intestines. The two terms may be used together to signify a disease of the stomach and intestines, as gastroenteritis.

COLIC

The most frequent disease of the horse is what is termed "colic," and many are the remedies that are reputed to be "sure cures" for this disease. The term "colic" is applied loosely to almost all diseases of the organs of the abdomen that are accompanied with pain. If the horse evinces abdominal pain, the animal probably will be considered as suffering with colic, no matter whether the difficulty is a cramp of the

bowel, an internal hernia, overloading of the stomach, or a painful disease of the bladder or liver. Since these conditions differ so much in their cause and their nature, one should not expect the same drugs or procedures to relieve them all. Therefore, it is important that, as far as possible, the various disease states that are so roughly classed together as colic be separated in order that appropriate treatments may be prescribed. With this object in view, colics are considered under the following headings: (1) Engorgement colic, (2) obstruction colic, (3) flatulent or tympanitic colic, (4) spasmodic colic. Worm colic is referred to under the heading "Gastrointestinal Parasites," p. 73.

The general symptoms of abdominal pain, and therefore of colic, are restlessness, cessation of whatever the horse is doing, lying down, looking around toward the flank, kicking with the hind feet upward and forward toward the belly, jerky switching of the tail, stretching as though to urinate, frequent change of position, and groaning. In the more intense forms the horse plunges about, throws itself, rolls, assumes unnatural positions, as sitting on the haunches, and grunts loudly. Usually the pain is not constant, and during the intermissions the horse may eat and appear normal. During the period of pain sweat is poured out freely. Sometimes the horse moves constantly in a circle. The respirations are accelerated, and usually there is no fever.

ENGORGEMENT COLIC

This form of colic consists in an overloading of the stomach with feed. The horse may have been overfed, or the feed may have collected in the stomach through failure of this organ to digest it and pass it backward into the intestines. Even a normal quantity of feed that the horse is unaccustomed to may cause disease. Hence a sudden change of feed may produce engorgement colic. Continued full rations while the horse is resting for a day or two or working too soon after feeding may serve as a cause. New oats, corn, or hay, damaged feed, or that which is difficult of digestion, such as barley or beans, may incite engorgement colic. This disease may result from the horse having been fed twice by error or from its having escaped and taken an unrestricted meal from the grain bin. Ground feeds that pack together, making a sort of dough, may cause engorgement colic if they are not mixed with cut hay. Greedy eaters are predisposed to this disease.

Symptoms.—The horse shows the general signs of abdominal pain, which may be long continued or of short duration. Retching or vomiting movements are made; these are shown by labored breathing, upturned upper lip, contraction of the flank, active motion at the throat, and drawing in of the nose toward the breast, causing high

arching of the neck. The horse may assume a sitting position like a dog. At times the pain is very great and the horse makes the most violent movements, as though mad. At other times there is profound mental depression, the horse standing in a sleepy, or dazed, way, with the head down, the eyes closed, and leaning his head against the manger or wall. There is, during the struggles, profuse perspiration. Following retching, gas may escape from the mouth, and this may be followed by a sour froth and some stomach contents. The horse cannot vomit except when the stomach is violently stretched, and, if the accumulation of feed or gas is great enough to stretch the stomach so that vomiting is possible, it may be great enough to rupture that organ. So it frequently happens that a horse dies from ruptured stomach after vomiting. After the stomach ruptures, however, vomiting is impossible. The death rate in this form of colic is high.

Treatment.—The bowels should be stimulated to contraction by the use of injections of large quantities of water and of glycerin. Veterinarians use hypodermic injections of eserine or arecoline or intravenous injections of barium chloride, but they must be employed with great caution. It is not advisable to give remedies by the stomach for they cannot be absorbed, although it is often necessary to administer sedatives to quiet excessive pain and prevent violent injuries. The treatment used by many veterinarians is to remove the contents of the stomach by means of the stomach tube. This treatment also permits the escape of gases from the stomach. Further treatment, except for careful feeding for a few days, is seldom necessary.

RUPTURE OF THE STOMACH

This mostly occurs as a result of engorged or tympanitic stomach (engorgement colic) and from the horse violently throwing itself when so affected. Rupture of the stomach may result from disease of the coats of the stomach, gastritis, stones (calculi), tumors, or anything that closes the opening of the stomach into the intestines, and violent pulling or jumping immediately after the animal has eaten heartily of bulky feed. These or similar causes may lead to this accident.

The symptoms of rupture of the stomach are not constant or always reliable. Always make inquiry as to what and how much the horse has been fed at the last meal. Vomiting may precede rupture of this organ, as previously stated. This accident appears to be most likely to occur in heavy draft horses. A prominent symptom observed (though it may also occur in diaphragmatic hernia) is when the horse, if possible, gets the front feet on higher ground than the hind ones or sits on his haunches, like a dog. This position affords relief to some extent, and it will be maintained for several minutes;

it is also quickly regained when the horse has changed it for some other. Colicky symptoms are present but vary much and have no diagnostic value. As the case progresses the horse often stretches forward the forelegs, leans backward and downward until the belly nearly touches the ground, and then rises up again with a groan, after which the fluid from the nostrils is issued in increased quantity. The pulse is fast and weak, breathing hurried, body bathed in a clammy sweat, legs tremble violently, the horse reels or staggers from side to side, and death quickly results.

In the absence of any pathognomonic symptom the following should be considered: History of the case; symptoms of colic that cease suddenly and are succeeded by cold sweats and tremors; pulse quick, small, and thready, growing weak and more frequent, and at length running down and becoming altogether imperceptible; looking back at the flank and groaning; sometimes crouching with the hind quarters; with or without eructation and vomiting.

There is no treatment that can be of any use.

OBSTRUCTION COLIC

The stomach or bowels may be obstructed by accumulations of partly digested feed (fecal matter), foreign bodies, displacements, paralysis, or abnormal growths.

IMPACTION OF THE LARGE INTESTINES

This is a common bowel trouble and one that if not promptly recognized and properly treated, results in death. It is caused by over-feeding, especially bulky feed containing an excess of indigestible residue; old, dry, hard hay, or stalks when largely fed; deficiency of secretions of the intestinal tracts; lack of water; want of exercise, and laxatives.

Impaction of the large bowels results in a slight abdominal pain, which may disappear for a day or two to reappear with more violence. The feces are passed somewhat more frequently but in smaller quantities and drier; the abdomen is full but not distended with gas; the horse at first paws and soon begins to look back at its sides. Probably one of the most characteristic symptoms is the position the animal assumes when down. It lies flat on its side, head and legs extended, occasionally raising its head to look toward the flank; it remains on the side for 5 to 15 minutes at a time. Evidently this position gives the most freedom from pain. The horse rises at times, walks about the stall, paws, looks at its sides, backs up against the stall pressing it with the tail, and soon lies down again, assuming its favored position. The intestinal sounds, as heard by applying the ear to the flank, are diminished, or there is no sound, indicating absence of motion of the

bowels. The bowels may cease entirely to move. The pressure of the distended intestine upon the bladder may cause the horse to make frequent attempts to urinate. The pulse is but little changed at first, being full and sluggish; later, if this condition is not overcome, it becomes rapid and feeble. Horses may suffer from impaction of the bowels for a week, yet eventually recover, and cases extending 2 or even 3 weeks have ended favorably. As a rule, however, they seldom last more than 4 or 5 days, many, in fact, dying sooner than this.

Treatment.—This consists in efforts to produce movement of the bowels and to prevent inflammation of the same from arising. There is, however, considerable danger in the use of drastic cathartics. In many cases the impacted mass may be reached through the wall of the rectum and broken down to facilitate its passage. This operation as well as the administration of cathartics requires both judgment and skill. The untrained person may rupture the bowels in attempting to break down the impacted mass either by manipulation or injudicious use of cathartics. Some favor the administration of Epsom or Glauber's salt; others use linseed oil, mineral oil, or other agents. No single cathartic however administered, will relieve all cases of impaction. Various stimulants are frequently used. If nothing else is at hand and the veterinarian is not available, a pint of strong coffee may be given every few hours. Allow the horse all the water it will drink, and in some cases salt is given to encourage the drinking of water. All feed should be withheld until the bowels have moved freely. At times excessive quantities of gas accumulates in the intestines, necessitating relief by puncturing the bowels by means of a trocar and cannula.

Enemas of glycerin, 2 to 4 ounces, are often beneficial. Rubbing or kneading the abdominal walls and applying stimulating liniments or strong mustard water also, at times, favor the expulsion of this mass. The animal must occasionally be made to work. If this treatment is faithfully carried out from the beginning, most cases will terminate favorably. If relief is not obtained inflammation of the bowels may ensue and cause death.

CONSTIPATION, OR COSTIVENESS

This is often witnessed in horses, particularly in foals. Many foals die every year from failure on the part of the attendant to note the condition of the bowels soon after birth. Whenever the foal fails to pass any feces, and in particular if it shows any signs of colicky pains—straining, for instance—immediate attention must be given it. As a rule, it will be necessary only to give a few injections of soapy water in the rectum and to introduce the finger through the anus to break

down any hardened mass of dung found there. If this is not effective a purgative must be given. Oils are the best for these young animals, preferably castor oil, in doses of 2 to 4 ounces. The foal should always get the first of the mother's milk, which, for a few days, possesses decidedly laxative properties. If a mare, while suckling, is taking medicines, the foal during this time should be fed by hand and the mare milked upon the ground. Constipation in adult horses is often the result of long feeding on dry, innutritious feed, deficiency of intestinal secretions, scanty water supply, or lack of exercise. If the case is not complicated with colicky symptoms, a change to light, sloppy diet, linseed gruel or tea, with plenty of exercise, is all that is required. If colic exists a cathartic is needed. In many instances the constipated condition of the bowels is due to lack of intestinal secretions and when so caused may sometimes be helped by giving a handful of Epsom salts daily in the feed. It is always best to overcome this trouble by a change of diet rather than by the use of medicines. For the relief of constipation such succulent feeds as roots, grass, or green forage are recommended. Silage, however, should be fed sparingly and not at all unless it is in the very best condition. Moldy silage may cause death.

FOREIGN BODIES (CALCULI, STONES) IN THE STOMACH

There are probably few symptoms shown by the horse that will lead one to suspect the presence of gastric calculi, and possibly none by which one can unmistakably assert their presence. They have been found most frequently in millers' horses fed sweepings from the mills. A depraved and capricious appetite is common in horses that have a stone forming in the stomachs. There is a disposition to eat the woodwork of the stable, earth, and, in fact, almost any substance within their reach. This symptom, however, must not be considered as pathognomonic, since it is observed when calculi are not present. Occasional colics may result from these "stomach stones," and when the latter lodge at the outlet of the stomach they may give rise to symptoms of engorged stomach, already described. There is no treatment that will be effective. Remedies to move the bowels, to relieve pain, and to combat inflammation should be given.

INTESTINAL CONCRETIONS (CALCULI OR STONES IN THE INTESTINES)

These concretions are usually found in the large intestines, though they are occasionally seen in the small ones. They are of various sizes, weighing from 1 ounce to 25 pounds; they may be single or multiple and differ in composition and appearance, some being soft (composed mostly of animal or vegetable matter), whereas others

are porous, or honeycombed (consisting of animal and mineral matter), and others are entirely hard and stonelike. The hair balls, so common to the stomach and intestines of cattle, are rare in horses. Intestinal calculi form around some foreign body, as a rule—a nail or piece of wood—whose shape they may assume to a certain extent. Layers are arranged concentrically around such nucleus until the sizes, previously given, are attained. These stones also are often found in horses fed on byproducts of milling as well as in horses in limestone districts, where the water is hard. When the calculi attain a sufficient size and become lodged or blocked in some part of the intestines, they cause obstruction, inflammation of the bowels, colicky symptoms, and death. There are no certain signs or symptoms that reveal them. Recurring colics of the type of impaction colic, but more severe, may lead one to suspect the existence of this condition. Examination through the rectum may reveal the calculus.

The symptoms will be those of obstruction of the bowels. On post-mortem examinations these stones will be discovered mostly in the large intestines, which will be inflamed or gangrenous about the point of obstruction. Sometimes calculi have been expelled by the action of a physic, or they may be removed by the hand when found to occupy the rectum.

As in concretions of the stomach, little can be done in the way of treatment more than to overcome spasm (if any exists), and to give physics with the hope of dislodging the stone or stones and carrying them on and outward.

INTUSSUSCEPTION, OR INVAGINATION

This is the slipping of a portion of the intestine into another portion immediately adjoining, like a partially turned glove finger. This may occur in any part of the intestines, but is most frequent in the small ones. The invaginated portion may be slight—2 or 3 inches only—or extensive, measuring as many feet. In intussusception, the intumed bowel is in the direction of the anus. There are adhesions of the intestines at this point, congestion, inflammation, or even gangrene. This accident is most likely to occur in horses that are suffering from spasm of the bowel, or in those in which a small portion of the bowel is paralyzed. The natural wormlike or ringlike contraction of the bowel favors the passage of the contracted or paralyzed portion into that immediately behind it. It may occur during almost any abdominal trouble, as diarrhea, inflammation of the bowels, of from injuries or exposure to cold. A fall or leap may give the initial maldirection. Foals are most likely to be thus afflicted.

Unless the invaginated portion of the bowel becomes strangulated, probably no symptoms except constipation will be appreciable.

Strangulation of the bowel may take place suddenly, and the horse die within 24 hours, or it may occur after several days—a week even—and death then follow. There are no symptoms positively diagnostic. Colicky pains, more or less severe and continuous, are observed, and at first there may be diarrhea, followed by constipation. Severe straining occurs in some instances of intussusception. As death approaches, the horse sweats profusely, sighs, has an anxious countenance, the legs and ears become cold, and there is often freedom from pain immediately before death. In rare instances the animal recovers, even though the invaginated portion of the bowel has become strangulated. In this case the imprisoned portion sloughs away so gradually that a union has taken place between the intestines at the point where one portion has slipped into that behind it. The piece sloughing off is found passed with the manure. Such cases are exceedingly rare. Nonirritating laxatives, such as castor oil, sweet oil, or calomel in small doses, are usually preferred. Soft feed and mucilaginous and nourishing drinks should be given during these attacks. In selected cases a surgical operation consisting of opening the abdomen and releasing the imprisoned bowel has proved successful.

VOLVULUS, GUTTIE, OR TWISTING OF THE BOWELS

These are the terms applied to the bowels when twisted or knotted. This accident is rather a common one and frequently results from the violent manner in which a horse throws itself about when attacked by spasmodic colic. The symptoms are the same as those of intussusception and obstructions of the bowels; the same directions as to treatment are therefore to be observed.

PARALYSIS OF THE INTESTINE

This occurs in old, debilitated animals that have been fed coarse, innutritious fodder. This produces a condition of dilatation so pronounced as to make it impossible for the intestine to advance its contents, and so obstruction results. The symptoms are as in other forms of obstruction colic. The history of the case is of much service in diagnosing the trouble. Treatment consists in the administration of laxatives. One may give 1 quart of raw linseed oil and follow it the next day with 1 pound of Glauber's salt dissolved in a quart of warm water. Other appropriate medicaments to cause peristaltic movements are also recommended. If the stagnant mass of feces is in the rectum, it must be removed with the hand.

ABNORMAL GROWTHS

Tumors, fibrous tissue, or other abnormal growths, producing contraction or stricture, may be causes of obstruction. The colic caused

by these conditions is chronic. The attacks occur at gradually shortening intervals and become progressively more severe. Relief is afforded by the use of purgatives that render the feces soft and thin and thus enable them to pass the obstruction, but in time the contracted place is likely to close so far that passage is impossible and the horse will die.

FLATULENT COLIC (TYMPANIC COLIC, WIND COLIC, OR BLOAT)

Among the most frequent causes of this form of colic are sudden changes of feed, too long fasting and feed then given while the animal is exhausted, new hay or grain, large quantities of feed that is green or that has lain in the manger for some time and become sour, indigestible feed, irregular teeth, crib biting, and, in fact, anything that produces indigestion.

Symptoms.—The symptoms of flatulent colic are not so suddenly developed nor so severe as those of spasmodic, or cramp colic, described later. At first the horse is dull, paws slightly, and may or may not lie down. The pains from the beginning are continuous. The belly enlarges, and by striking it in front of the haunches a drum-like sound results. If the condition is not soon relieved the above symptoms are aggravated, and in addition difficult breathing, blood-shot eyes, and red mucous membranes, loud tumultuous heart beat, profuse perspiration, trembling of the forelegs, sighing respiration, staggering from side to side are noticed, and, finally, the animal plunges forward dead. The diagnostic symptom of flatulent colic is the distention of the bowels with gas, detected by the bloated appearance and resonance on percussion.

Treatment.—The treatment for flatulent colic differs greatly from that of cramp colic. Absorbents are of some service, and charcoal may be given in any quantity. Relaxants and antispasmodics, particularly those having antiferment qualities, are also beneficial. Aromatic spirits of ammonia in 1-ounce doses may be given at short intervals.

A physic is always advisable as early as possible in the treatment of flatulent colic. Blankets wrung out of hot water do much to afford relief; they should be renewed every 5 to 10 minutes and covered with a dry woollen blanket. This form of colic is much more fatal than cramp colic and requires prompt and persistent treatment. It is entirely unsafe to predict the result, some apparently mild attacks going on to speedy death, whereas others that at the onset appear to be very severe yield rapidly to treatment. No efforts should be spared until the animal is known to be dead. In these severe cases puncturing of the bowels by means of a small trocar and cannula or with a needle of a hypodermic syringe, thus allowing the escape of gas, has often saved

life. This is a surgical procedure and should be undertaken only by a veterinarian, except in cases of extreme emergency.

SPASMODIC OR CRAMP COLIC

This is the name given to that form of colic produced by contraction, or spasm, of a portion of the small intestines. It is produced by indigestible feed, large drinks of cold water when the animal is warm, driving a heated horse through deep streams, cold rains, drafts of cold air, and other causes. Unequal distribution of or interference with the nervous supply of the small intestines produces cramp in them, the same as external cramps are produced. Spasmodic colic occurs much more frequently in high-bred, nervous horses than in coarse, lymphatic ones.

Symptoms.—These should be carefully studied in order to diagnose this from other forms of colic requiring different treatment. Spasmodic colic always begins suddenly. If feeding, the horse is seen to stop abruptly, stamp impatiently, and probably look back. It soon evinces more acute pain, shown by pawing, suddenly lying down, rolling, and getting up. During the period of pain the intestinal sounds, as heard by applying the ear over the flank, are louder than in health. There is then an interval of ease; the animal will resume feeding and appear to be entirely well. In a little while, however, the pains return and are increased in severity, only to pass off again for a time. As the attack progresses these intervals of ease become shorter and shorter, and pain may be continuous, though even then there are periods in which the pain increases in violence. Animals suffering from this form of colic evince the most intense pain; they throw themselves, roll over and over, jump up, whirl about, drop down again, strike with the front feet, steam and sweat, and make frequent attempts to pass their urine. Only a small quantity is passed at a time; this is due to the bladder being so frequently emptied. These attempts to urinate are often regarded by horsemen as symptoms of trouble of the kidneys or bladder. In reality they are only one of the many ways in which the horse expresses the presence of pain. As a matter of fact, diseases of the bladder or kidneys of the horse are exceedingly rare.

To recapitulate the symptoms of spasmodic colic: The history of the case, the type of horse, the suddenness of the attack, the increased intestinal sounds, the intervals of ease (which become of shorter duration as the case progresses), the violent pain, the normal temperature and pulse during the intervals of ease, and the frequent attempts to urinate, should be kept in mind, and there is then little danger of confusing this with other forms of colic.

Treatment.—Since the pain is due to spasm or cramp of the bowels, medicines that overcome spasms should be used. The body should be warmly clothed and perspiration induced. Dipping blankets in very hot water to which a small quantity of turpentine has been added, placing them around the belly, and covering with dry blankets is recommended, or the abdomen may be rubbed with stimulating liniments or mustard water. The difficulty, however, of applying hot blankets and keeping them in place in most instances makes this method impracticable. If the cramp is due to irritants in the bowels, a cure cannot be expected until the offending material is expelled. Injections of warm, soapy water or salt and water into the rectum may aid the cure.

Exercise will aid the action of the bowels in this and similar colicky troubles, but severe galloping or trotting is to be avoided. A loose box or paddock for the horse will enable it to take what exercise it wants. If the patient is extremely violent, it is often wise to use restraint by leading with a halter, since rupture of the stomach or displacement of the bowels may result and complicate the trouble.

INDIGESTION OR GASTROINTESTINAL CATARRH

From the facts that they merge insensibly into each other and usually occur simultaneously, there is ample reason for considering these conditions together. This condition may be acute—that is, of sudden onset—or it may be chronic. The changes of structure produced by this disease occur in the mucous membrane lining of the stomach and intestines. This membrane becomes red from increased blood supply or from hemorrhage into it, is swollen, and is covered by a coating of slimy mucus. In some especially severe cases the membrane is destroyed in spots, causing the appearance of ulcers or of erosions.

The causes of indigestion are numerous, but nearly all are the result of errors in feeding.

Some horses naturally have weak digestive organs, and such animals are predisposed to this condition. Anything that irritates the stomach or intestines may cause this disease. Feeds that the animal is unaccustomed to, sudden changes of diet, imperfectly cured, unripe, or damaged feeds, and worms—are all fruitful causes. In suckling foals this condition may come from some disease of the dam that renders her milk indigestible, or from overexertion or overheating of the mare. Another prolific cause is bad teeth, making mastication imperfect, and thus causing the horse to swallow the feed in a condition unfit for the action of the digestive juices. Working a horse too soon or too hard after feeding may cause either colic or indigestion. Any condition that reduces the vitality, such as disease,

overwork, poor feed, or lack of care, may directly bring on indigestion by weakening the digestive organs.

Symptoms.—Indigestion is characterized by irregular appetite, the animal refusing all feed at times, and at others eating ravenously. The appetite is not only irregular but also is often depraved; there is a disposition on the part of the horse to eat unusual substances, such as wood, soiled bedding, or even its own feces. The bowels are irregular, loose, and bad smelling on one day and are bound the next day; whole grain is often passed in the feces, and the hay passed in balls or impacted masses, undergoing little change; the horse frequently passes considerable quantities of sour-smelling gas. The animal loses flesh, the skin has a hard, dry appearance and seems very tight (hide-bound). If the stomach is seriously involved, the horse may yawn by stretching the head forward and upward and by turning the upper lip outward. There may be more or less colicky pain. In the chronic cases there is mental depression; the horse is sluggish and dull. The abdomen gradually becomes small, giving a "tucked up" appearance, or, on the other hand, it becomes flaccid and pendulous.

Treatment.—One should commence with the feed—its quality, quantity, and time of feeding. Examine the water supply, and see, besides, that it is given before feeding; then carefully observe the condition of the mouth and teeth; and, continuing the observations, endeavor to find the seat of the trouble. If the teeth are sharp or irregular they must be rasped down; if any are decayed they must be extracted; if indigestion is due to ravenous eating or bolting, the feed must then be given from a large manger where the grain can be spread and the horse thus compelled to eat slowly.

Any irritation, such as worms or undigested feed, that is operating as a cause is to be removed by appropriate treatment, as advised elsewhere.

DIARRHEA

Diarrhea is due to indigestion or intestinal catarrh or to irritation of the bowels from eating moldy or musty feed, drinking stagnant water, diseased condition of the teeth, eating irritating substances, being kept on low, marshy pastures, and exposure during cold nights or in low, damp stables. Some horses are predisposed to scour and are called "washy" by horsemen; such animals have long bodies, long legs, and narrow, flat sides. Horses of this build are almost sure to scour if fed or watered immediately before being put to work. Fast or road work aggravates this trouble. Diarrhea may exist as a complication of other diseases, as pneumonia and influenza, for instance, and again during the diseases of the liver.

The symptoms are frequent evacuations of liquid stools, with or without pronounced abdominal pain, loss of appetite, and emaciation.

Treatment.—This at times is simple but requires the utmost care and judgment. If diarrhea is due to faulty feed or water it is sufficient to change these. If it results from some irritant in the intestines this is best gotten rid of by the administration of an oleaginous purge, for which nothing is better than castor oil, although raw linseed oil may be used if the case is not severe. The diarrhea often disappears with the cessation of the operation of the medicine. If, however, the trouble continues it may be checked by giving wheat flour in water, starch water, white-oak bark tea, or chalk. Good results may follow the use of subnitrate of bismuth, 1 ounce, repeated three times a day. In all cases consideration should be given to the water and feed that the horse is receiving. If either of these is at fault it is at once to be discontinued. Good, easily digested feeds should be given sparingly. With that peculiar build of nervous horse that scours on the road, little can be done as a rule. Such an animal should be watered and fed as long as possible before going on a drive. Be slow to resort to either the vegetable or mineral astringents, since most cases will yield to change of feed and water or the administration of oils. Afterward feed wheat-flour gruel or other light feeds. The body should be warmly blanketed.

Superpurgation.—This is the designation of that diarrhea, or flux from the bowels, that, at times, is induced by and follows the action of a physic. It is accompanied with much irritation or even inflammation of the bowels and is always of a serious character. Although in rare instances it follows from a usual dose of physic and where every precaution has been taken, it is most likely to result under the following circumstances: Too large a dose of physic; giving physics to horses suffering from pneumonia, influenza, or other debilitating diseases; riding or driving a horse when purging; exposure or drafts of cold air; or giving large quantities of cold water while the physic is operating. There is always danger of superpurgation if a physic is given to a horse suffering from diseases of the respiratory organs. Small and often-repeated physics are also to be avoided, as they produce debility and great depression of the system and predispose to this disorder. When a physic is to be given one should rest the horse and give him sloppy feed until the medicine begins to operate, clothe the body with a warm blanket, keep the animal out of drafts, give only warm water in small quantities. After a horse has purged from 12 to 24 hours it can mostly be stopped, or "set," as horsemen say, by feeding dry oats and hay. Should the purging continue, however, it is best treated by giving demulcent drinks—linseed tea and oatmeal or wheat-flour gruel. After this the astringents recommended for diarrhea may be given. Besides this the horse is to receive brandy in doses of 2 to 4 ounces, with milk and eggs, four or five times a day.

Laminitis (founder) is a frequent sequel of superpurgation and is to be guarded against by removing the shoes and standing the horse on moist sawdust or similar bedding.

DYSENTERY

This disease, sometimes called bloody flux, is an intestinal disease attended with fever, occasional abdominal pains, and fluid discharges mingled with blood. Discharges in dysentery are coffee-colored or bloody, liquid, and very offensive in odor, and passed with much straining. It is rare in the horse but is sometimes prevalent among foals.

Causes.—Probably the most common cause is keeping young horses in particular for a long time on low, wet, marshy pastures, without other feed (a diarrhea of long standing sometimes terminates in dysentery); exposure during cold, wet weather; decomposed feeds; stagnant water that contains large quantities of decomposing vegetable matter; low, damp, and dark stables, particularly if crowded; the existence of some disease, as tuberculosis of the abdominal form. In suckling foals it may come from feeding the dam on irritant feeds or from disease of the udder. In other foals it may be produced by exposure to cold and damp, to irritant feed, or to worms.

Symptoms.—The initial symptom is a chill, which probably escapes notice in most instances. The discharges are offensive and for the most part liquid, although it is common to find lumps of solid fecal matter floating in this liquid portion; shreds of mucous membrane and blood may be passed or the evacuations may be mucopurulent; there is much straining, and, rarely, symptoms of abdominal pain; the animal lies down a great deal; the pulse is quickened and the temperature elevated. Thirst is a prominent symptom. In the adult, death rarely follows in less than 2 to 3 weeks, but in foals the disease may end in death after a few days.

Treatment.—Good care and feed are more important than any medication that may be adopted, but even with the best attention the animal may die. First of all the horse must be placed in a dry, warm, yet well-ventilated stable; the body should be rubbed frequently, blankets and bandages applied to the legs. The water must be pure and given in small quantities; the feed, light and easily digested. Medicinally, a light dose of castor oil, about one-half pint, may be given early in the disease. Opiates that are available to the licensed veterinarian are often effective either in combination with oils or with starch for rectal injection. The vegetable or mineral astringents may also be given. The strength must be kept up by milk punches, eggs, beef tea, or oatmeal gruel. In spite of the best care and treatment, however, dysentery is likely to be fatal. In suckling foals, the dam

should be put in a healthy condition if possible; otherwise milk should be obtained from another mare or from a cow. If it is necessary to use cow's milk it should not be too rich in butterfat, preferably from a recently freshened cow, and should be diluted about one-half with fresh water. A tablespoonful of sugar and about 3 teaspoonfuls of limewater should be added for each pint. This mixture should be supplied to the foal at about body temperature.

GASTROENTERITIS

This condition consists in an inflammation of the stomach and intestines. Instead of being confined to the mucous, or lining, membrane, as in gastrointestinal catarrh, the inflammatory process extends deeper and may even involve the entire thickness of the wall of the organ.

This disease may be caused by irritant feed, hot drinks, sudden chilling, moldy or decayed feeds, foul water, parasites, or by chemical poisons. It may also complicate some general diseases, especially infectious diseases, as anthrax, influenza, rabies, or petechial fever. Long-continued obstruction of the bowels or displacement resulting in death are preceded by enteritis.

Symptoms.—The symptoms differ somewhat with the cause and depend also, to some extent, on the chief location of the inflammation. In general the animal stops eating or eats but little; it has colicky pain; fever develops; the pulse and respiration become rapid; the mucous membrane becomes red; the mouth is hot and dry. Pressure on the abdomen may cause pain. Intestinal sounds cannot be heard at the flank. In the earlier stages there is constipation followed later by diarrhea. The extremities become cold. Sometimes the feces are coated with or contain shreds of fibrin, which look like scraps of dead membrane, and have a putrid odor. If the disease is caused by moldy or damaged feed there may be great muscular weakness, with partial paralysis of the throat, as shown by inability to swallow. If chemical poisons are the cause, this fact may be shown by the sudden onset of the disease, the history of the administration of a poison or the entire absence of known cause, the rapid development of threatening symptoms, the involvement of a series of animals in the absence of a contagious disease, and the special symptoms and alterations known to be produced by certain poisons. To make this chain of evidence complete, the poison may be discovered in the organs of the horse by chemical analysis. In nearly all cases of gastroenteritis there is nervous depression.

The poisons that are most irritant to the digestive tract are arsenic, corrosive sublimate, sugar of lead, copper sulfate, zinc sulfate or zinc chloride, lye or other strong alkalies, mineral acids, and, among the vegetable poisons, tobacco, lobelia, and water hemlock.

Treatment.—Treatment will depend on the cause, but if this cannot be detected, certain general indications may be observed. In all cases feed should be given in small quantities and should be soothing as oatmeal gruel, flaxseed tea, hay tea, fresh grass, or rice water. The skin should be well rubbed with alcohol and wisps of straw, to equalize the distribution of the blood. The legs, after being rubbed until warm, should be bandaged in raw cotton or with woolen bandages. The horse should be warmly blanketed. It is well to apply to the abdomen blankets wrung out of hot water and frequently changed, or mustard paste may be rubbed on the skin of the belly. Internally, sedatives to allay pain, check secretion, and soothe the inflamed membrane may be given. If there is obstinate constipation and if a laxative must be employed, it should be sweet or castor oil, from 1 pint to 1 quart. Appropriate stimulants may also be given.

Antidotes for poisons.—For the various poisons the remedies are as follows:

Arsenic: Ferric hydroxide suspended in water; or calcined magnesia, one-half ounce in 1 pint of water.

Corrosive sublimate (bichloride of mercury): The whites of a dozen eggs or 2 ounces of flowers of sulfur.

Sugar of lead: Glauber's salt, 1 pound in 1 quart of warm water, to be followed with potassium iodide, 3 drams at a dose, in water, three times daily for 5 days.

Sulfate of copper: Milk, the whites of eggs, or reduced iron.

Zinc sulfate or zinc chloride: Milk, the whites of eggs, or calcined magnesia.

Lye or alkalies, as caustic potash or soda: Vinegar, dilute sulfuric acid, and linseed tea.

Mineral acids: Chalk, or calcined magnesia, or baking soda; and later give linseed tea.

HEMORRHOIDS (PILES)

Hemorrhoids are comparatively rare in horses. They are diagnosed by the appearance of bright-red irregular tumors after defecation, which may remain visible at all times or be seen only when the horse is down or after passing his manure. They are mostly due to constipation, irritation, or injuries, or follow from the severe straining during dysentery. They sometimes follow severe labor pains in the mare.

Treatment.—Attention must be paid to the condition of the bowels, the contents of which should be soft, but purging is to be avoided. The tumors should be washed in warm water and thoroughly cleansed, after which scarify them and gently but firmly squeeze out the liquid that will be seen to follow the shallow incisions. After thus squeezing these tumors and before replacing through the anus, bathe the parts

with a solution of 1 teaspoonful of salt to a quart of water. Mucilaginous injections into the rectum may be beneficial for a few days. Sometimes the condition becomes aggravated, necessitating the services of a veterinarian.

HERNIA (RUPTURE)

There are several kinds of hernias that require notice, not all of which, however, produce serious symptoms or results. Abdominal hernias, or ruptures, are divided into reducible, irreducible, and strangulated, according to condition, and into inguinal, scrotal, ventral, umbilical, and diaphragmatic, according to their situation. A hernia is reducible when the displaced organ can be returned to its natural location. It consists in a soft swelling, without heat, pain, or any uneasiness, generally larger when the animal is on full feed, and decreases in size as the bowels become empty. An irreducible hernia is one that cannot be returned into the abdomen and yet does not cause any pain or uneasiness. Strangulated hernia is one in which the contents of the sac are greatly distended, or when from pressure on the blood vessels of the imprisoned portion the venous circulation is checked or stopped, thereby causing congestion, swelling, inflammation, and if not relieved, gangrene of the part and death of the animal. According to the time or mode of origin, hernias may be congenital or acquired.

CONGENITAL SCROTAL HERNIA

Some foals at birth have an enlarged scrotum, which gradually increases in size until about the sixth month, sometimes longer. Sometimes the scrotum of a 6-month-old colt is as large as that of an adult stallion, and operative treatment is considered. This is unnecessary in most cases, as the enlargement often disappears by the time the colt has reached his second year. Any interference, medicinal or surgical, is worse than useless. If the intestine contained within the scrotum should at any time become strangulated, it must then be treated the same as in an adult horse.

SCROTAL HERNIA

This is caused by dilatation of the sheath of the testicle, combined with relaxation of the fibrous tissues surrounding the inguinal ring, thus allowing the intestine to descend to the scrotum. At first this is intermittent, appearing during work and returning when the horse is at rest. For a long time this form of hernia may not cause the least uneasiness or distress. In course of time, however, the imprisoned intestine becomes filled with feces, its return into the abdominal cavity is prevented, and it becomes strangulated. While the intestine is thus filling, the horse often appears dull, is disinclined

to move, appetite is impaired, and there are rumbling and obstruction of the bowels. Colicky symptoms now supervene. Strangulation and its consequent train of symptoms do not always follow in scrotal hernia, for often horses have this condition for years without suffering inconvenience.

Inguinal hernia.—This is but an incomplete scrotal hernia, and, like the latter, may exist and cause no signs of distress, or, again, it may become strangulated and cause death. Inguinal hernia is seen mostly in stallions, next in geldings, and rarely in the mare. When during colicky symptoms, a horse kicks with his hind feet while standing or lying on his back, the inguinal region and scrotum should be examined for hernia. If scrotal hernia exists, the scrotum will be enlarged and lobulated; pressure may force a portion of the contents of the intestine back into the abdomen, eliciting a gurgling sound. If a gentle firm hold is taken on the enlarged scrotum and then an assistant causes the horse to cough, the swelling will be felt to expand and as quickly contract again.

The history of these cases will be of material assistance, as the owner can often assure one of preceding attacks of colic, more or less severe, that have been instantaneously relieved in some (to him) unaccountable manner. The colicky symptoms of these hernias are not diagnostic, but, probably, more closely resemble those of enteritis than any other bowel disease. In many cases the diagnosis can be made only by a veterinarian, when he has recourse to a rectal examination; the bowels can here be felt entering the internal abdominal ring.

After the existence of hernia has been ascertained, the veterinarian secures the horse on its back, and, with a hand in the rectum, endeavors to catch hold of the wandering bowel and pull it gently back into the cavity of the abdomen. Pressure is made on the scrotum during this time. If this fails, the hernia is reduced by means of incising the inguinal ring and replacing the intestines. Castration by the "covered operation" then follows.

Ventral hernia.—In this form of hernia the protrusion is through some accidental opening or rupture of the abdominal wall. It may occur at any part of the belly except at the umbilicus, and is caused by kicks, blows, hooks, severe jumping or pulling, or similar causes. Ventral hernia is most common in pregnant mares and in these animals is due to the weight of the fetus or to some degenerative changes taking place in the abdominal coats. It is recognized by the appearance of a swelling, at the base of which can be felt the opening or rent in the abdominal tunics, and from the fact that the swelling containing the intestines can be made to disappear when the animal is placed in a favorable position.

Treatment.—In many instances there is no occasion for treatment; furthermore, if the hernial sac is extensive, treatment is of no avail. If the hernia is small, a cure may be attempted by the methods described in treating umbilical hernia. If one is fortunate enough to be present when the hernia occurs, and particularly if it is not too large, he may, by the proper application of a pad and broad bandage, effect a perfect cure.

Umbilical hernia.—In this form any portion of the bowel or omentum ("caul") passes through the navel, forming a "tumor" at this point. This is often congenital, and is due to the imperfect closure of the umbilicus and to the position of the body. Many cases of umbilical hernia, like inguinal and scrotal of the congenital kind, disappear entirely by the time the animal reaches its second or third year. Advancing age favors cure in these cases from the fact that the omentum (swinging support of the bowels) is proportionally shorter in adults than in foals, thus lifting the intestines out of the hernial sac and allowing the opening in the walls to close. Probably one of the most frequent causes of umbilical hernia in foals is the practice of keeping them too long from their dams, causing them to fret and worry, and to neigh, or cry, by the hour. The contraction of the abdominal muscles and pressure of the intestines during neighing seem to open the umbilicus and induce hernia. Accidents may cause umbilical hernia in adults in the same manner as ventral hernia is produced, though this is rare.

Treatment.—In the treatment of umbilical hernia it should be remembered that congenital hernias are often removed with age, but probably congenital umbilical hernias less frequently than others. One method of treatment is to apply a pad over the tumor, the pad being held in place by a broad, tight bandage placed around the animal's body. The chief objection to this is the difficulty in keeping the pad in its place. Blisters are often applied over the swelling, and, as the skin hardens and contracts by the formation of scabs, an artificial bandage or pressure is produced that at times is successful.

Another method is as follows: After the animal is fasted for a few hours, it is cast and secured on its back; the bowel is then carefully returned into the abdomen. The skin over the opening is pinched up and one or two skewers are run through the skin from side to side as close as possible to the umbilical opening. These skewers are kept in place by passing a cord around the skin between them and the abdomen and securely tying it. Great care must be taken not to draw these cords too tight, as this would cause a speedy slough of the skin, the intestines would extrude, and death result. If the cords are properly applied, an adhesion is established between the skin and the umbilicus, which effectually closes the orifice. Special clamps are

provided for taking up the fold of the skin covering the hernial sac and holding it until the adhesion is formed.

Diaphragmatic hernia.—This consists in the passage of any of the abdominal viscera through a rent in the diaphragm (midriff) into the cavity of the thorax. It is a rather rare accident and one often impossible to diagnose during life. Colicky symptoms, accompanied with great difficulty in breathing, and the peculiar position so often assumed (that of sitting on the haunches), are somewhat characteristic of this trouble, though these symptoms may be present during diseases of the stomach or anterior portion of the bowels. Even if this form of hernia could be diagnosed with certainty, there is little or nothing that can be done. Leading the horse up a very steep gangway or causing it to rear up may possibly cause the hernial portion to return to its natural position. This is not enough, however, it must be kept there.

PERITONITIS

Peritonitis is an inflammation of the serous membrane lining the cavity of and covering the viscera contained within the abdomen. It is very rare to see a case of primary peritonitis. It is, however, somewhat common as a secondary disease from extension of the inflammatory action involving organs covered by the peritoneum. Peritonitis is often caused by injuries, as punctured wounds of the abdomen, severe blows or kicks, or, as is still more common, following the operation of castration. It follows strangulated hernia, invagination, or rupture of the stomach, intestines, liver, or womb.

Symptoms.—Peritonitis is mostly preceded by a chill; the horse is not disposed to move, and, if compelled to do so, moves with a stiff or sore gait; it paws with the front feet and may strike at its belly with the hind ones; lies down very carefully; as the pain is increased while down, the animal maintains the standing position during most of the time; it walks uneasily about the stall. Constipation is usually present. Pressure on the belly causes acute pain, and the horse will bite, strike, or kick if so disturbed; the abdomen is tucked up; the extremities are cold. The temperature is higher than normal, reaching 102° to 104° F. The pulse in peritonitis is rather characteristic; it is quickened, beating 70 to 90 times a minute, and is hard and wiry. This peculiarity of the pulse occurs in inflammation of the serous membrane, and if accompanied with colicky symptoms, and, in particular, if following any injuries, accidental or surgical, of the peritoneum, there is reason to think that peritonitis is present. Peritonitis in the horse is mostly fatal when it is at all extensive. If death does not occur in a short time, the inflammation assumes a chronic form, in which there is an extensive effusion of water in the abdominal

cavity, constituting what is known as ascites, and which, as a rule, results in death.

Treatment.—The treatment of peritonitis is somewhat like that of enteritis. Opiates are commonly used, being sometimes combined with calomel. Extensive counterirritants over the belly, consisting of mustard plasters, applications of mercurial ointment, turpentine stupes, or even mild blisters, are recommended. Purgatives must never be given during this complaint. Moving the bowels can be done by gentle enemas, though it is seldom necessary to resort even to this.

ASCITES (DROPSY OF THE ABDOMEN)

Ascites occurs as a result of subacute or chronic peritonitis but may be due to diseases of the liver, kidneys, heart, or lungs. There will be found, on opening the abdominal cavity, a large collection of yellowish or reddish liquid; from a few quarts to several gallons may be present. It may be clear in color, though generally it is yellowish or of a red tint and contains numerous loose flakes of coagulable lymph.

Symptoms.—There are slight tenderness on pressure and awkward gait of the hind legs. The horse is dull and may have occasional slight colicky pains, shown by looking back and striking at the belly with the hind feet. Oftener, however, these colicky symptoms are absent. Diarrhea often precedes death, but during the progress of the disease the bowels are alternately constipated and loose. On percussing the abdominal walls dullness is found to exist to the same height on both sides of the belly; by suddenly pushing or striking the abdomen one can hear the rushing or flooding of water. If the case is an advanced one, the horse is potbellied in the extreme, and dropsical swellings are seen under the belly and upon the legs.

Treatment.—Treatment is, as a rule, unsatisfactory. Saline cathartics, as Epsom or Glauber's salt, and diuretics, may be given. If a veterinarian is at hand he will withdraw the accumulation of water by tapping and then endeavor to prevent its recurrence (though this is almost sure to follow) by giving a diuretic, and by the application of mustard or blisters over the abdominal walls. Tonics, mineral and vegetable, may be beneficial. Good nutritious feeds and gentle exercise complete the treatment.

DISEASES OF THE LIVER

In the United States the liver of the horse is rarely the seat of disease, and when one considers how frequently the liver of man is affected this cannot but appear strange. The absence of the gall bladder in the horse may account to a certain extent for its freedom from liver diseases, as overdistention of this and the presence

in it of calculi (stones) in man is a frequent source of trouble. In domestic animals, as in man, hot climates tend to produce diseases of the liver, just as in cold climates lung diseases prevail. Not only are diseases of the liver rare in horses in temperate climates, but they are also very obscure, and in many cases pass totally unobserved until after death. When some symptoms, however, are present, the liver should be examined as carefully as possible. These are jaundice (yellowness of the mucous membranes of the mouth, nose, and eyes) and the condition of the dung, which is light in color and pasty in appearance.

HEPATITIS, OR INFLAMMATION OF THE LIVER

This disease may be general or local and may assume an acute or chronic form.

Symptoms.—The symptoms of acute hepatitis are dullness, internal pain but not of a severe type, constipated and clay-colored dung balls, scanty and high-colored urine; and general febrile symptoms. When lying down, the horse is mostly found on the left side. It looks occasionally toward the right side, which, on close inspection, may be found to be slightly enlarged over the posterior ribs, where pain on pressure is also evinced. Obscure lameness in front, of the right leg mostly, may be a symptom of hepatitis. The horse, toward the last, reels or staggers and falls backward in a fainting fit, during one of which it finally succumbs. Death is sometimes due to rupture of the enveloping coat of the liver or of some of its blood vessels.

Causes.—Among the causes that lead to this disease is the stimulating effect of overfeeding, particularly during hot weather. Horses that are well fed and receive little exercise are the best subjects for diseases of this organ. Other more mechanical causes are injuries on the right side over the liver, worms in the liver, gallstones in the biliary ducts, foreign bodies—as needles or nails that have been swallowed and in their wanderings have entered the liver—and, lastly, in some instances, the extension of inflammation from neighboring parts, thus involving this organ. Acute hepatitis may terminate in chronic inflammation, abscesses, rupture of the liver, or may disappear, leaving behind no trace of disease whatever.

Treatment.—This should consist, at first, in the administration of an appropriate physic. Saline medicines, as Glauber's salt or the artificial Carlsbad salt, are beneficial. These may be given with the feed in tablespoonful doses. The horse should be fed sparingly on soft feed, bran mash chiefly. If treatment proves successful and recovery takes place, see to it that the horse afterwards gets regular exercise and that the feed is not of a too highly nutritious character and not excessive.

JAUNDICE (ICTERUS OR THE YELLOWS)

Jaundice is a condition caused by the retention and absorption of bile into the blood. It was formerly considered to be a disease of itself but is now regarded as a symptom of disorder of the liver. Jaundice is observed by looking at the eyes, nose, and mouth, when it will be seen that these parts are yellowish instead of the pale-pink color of health. In white or light-colored horses the skin even may show this yellow tint. The urine is saffron colored, the dung is of a dirty-gray color, and constipation is usually present. Jaundice may be present as a symptom of almost any inflammatory disease. When an animal has fever the secretions are checked, the bile may be retained and absorbed throughout the system, and yellowness of the mucous membranes follows. Jaundice may also exist during the presence of simple constipation, hepatitis, biliary calculi, abscesses, or hardening of the liver.

Treatment.—When jaundice exists the endeavor must be to rid the system of the excess of bile, and this may be accomplished to some extent by giving appropriate purgatives. Glauber's salt in handful doses once or twice a day for a week is also helpful. The bowels should be kept open by avoiding hard, dry, bulky feeds.

RUPTURE OF THE LIVER

This is known to occur at times in the horse, most frequently in old, fat horses and those that get little exercise. Horses that have suffered from chronic liver disease for years eventually show symptoms of colic and die suddenly. On post mortem examination it is found that the liver has ruptured. The cicatrices, or scars, that are often found on the liver indicate that this organ may suffer small rupture and yet the horse may recover from it. This cannot be the result, however, if the rent or tear is extensive, since in such cases death must quickly follow from hemorrhage, or, later, from peritonitis. Enlarged liver is particularly likely to rupture.

The immediate causes of rupture appear to be excessive muscular exertion, as jumping a fence, a fall, a blow from a collision, a kick from a horse, or sudden distention of the abdomen with gas.

The symptoms of rupture of the liver depend on the extent of the laceration. If slight, there will be simply the symptoms of abdominal pain, looking back to the sides, lying down, etc.; if extensive, the horse is dull and dejected, has no appetite, breathing becomes short and catching, it sighs or sobs, visible mucous membranes are pale, extremities cold, pulse fast, small, and weak or running down. The countenance now shows much distress, the animal sweats profusely, totters in his gait, props its legs apart, reels, staggers, and falls. It may get up again, but soon falls dead. The rapid running-down

pulse, paleness of the eyes, nose, and mouth, sighing, stertorous breathing, and tottering gait, are indications that the animal is dying from internal hemorrhage.

Treatment.—Little can be done in the way of treatment. Sedatives may be given to keep the animal as quiet as possible to prevent aggravating the condition. Drugs to assist in checking the internal hemorrhage may also be administered. Cold water dashed on the right side or injected into the rectum may be used as a means of checking the hemorrhage.

BILIARY CALCULI (GALLSTONES)

Gallstones are rarely found in the horse but may occupy the hepatic ducts, giving rise to jaundice and to colicky pains. There are no absolutely diagnostic symptoms, but should one find a horse that suffers from repeated attacks of colic, accompanied with symptoms of violent pain, and that during or following these attacks is jaundiced, it is possible that gallstones are present. There is little or nothing to be done except to give medicines to overcome pain, trusting that these concretions may pass on to the bowels, where, from their small size, they will not occasion any inconvenience.

DISEASES OF THE PANCREAS AND SPLEEN

Diseases of the pancreas and spleen are rare and their symptoms are little understood. Accordingly no information of practical value can be given at present concerning them.

GASTROINTESTINAL PARASITES¹

[By Maurice C. Hall, Ph. D., D. Sc., D. V. M.]

Horses are subject to infestation by a number of species of worms, these worms being especially numerous at certain points in the alimentary canal.

The tapeworms of the horse are relatively unimportant and not common. There are three species, the smallest about 2 inches long and the largest about 8 inches long. These two occur in the small intestine; a form intermediate in size may also be found in the cecum and colon. These are flat, segmented worms with the head at the smaller end.

Flukes occur in horses elsewhere but have apparently never been reported in the United States.

Roundworms, or nematodes, constitute the most important group of parasitic worms in the horse. The more important of these are discussed in the following paragraphs.

¹ Further details concerning internal parasites of horses may be obtained from Circular 148, Parasites and Parasitic Diseases of Horses, and Farmers' Bulletin 1503, Horse Bots and their Control.

ROUNDWORM (ASCARIS EQUI)

This is the common, large, yellowish roundworm (pl. V, fig. 5), about the size of a lead pencil or larger, that may be found in horses almost anywhere in the United States. It occurs in the intestine and probably occasions little damage as a rule, except when present in large numbers, in which case it will probably be found in the droppings. The symptoms occasioned by it are rather obscure and are such as might arise from a number of other causes, namely, colicky pains, depraved appetite, diarrhea or constipation, and general unthriftiness. In a general way, the presence of parasites may be suspected when an animal has no fever but is unthrifty, debilitated, and has disordered bowel movements in cases where there is no evident explanation in the way of feed, care, and surroundings.

Treatment.—Treatment for the removal of this worm consists in the use of anthelmintics such as carbon tetrachloride or carbon bisulfide, but as these remedies are essentially poisons intended to kill the worm, and as their use by persons unused to determining conditions unfavorable for their use is dangerous and likely to result in the death of the animal or in permanent injury, it is advisable to call in a veterinarian in such cases.

PINWORM (OXYURIS EQUI)

This is a rather large worm (pl. V, fig. 1), somewhat smaller than the foregoing and readily distinguishable from it by the presence of a long, slender tail. It also occurs generally throughout the United States, and except when present in large numbers probably does little damage. Pinworms can be removed by the use of suitable doses of oil of chenopodium or oil of turpentine. As these treatments are dangerous in the hands of persons not accustomed to using them, it is recommended that the drugs in question be administered by a competent veterinarian.

STOMACH WORM (HABRONEMA SPP.)

These worms (pl. V, fig. 4) occur on the stomach wall, free or attached, and in nodules in the mucous lining of the horse's stomach and are credited with doing more or less damage. Their presence is not likely to be determined, but in case it is determined or suspected in connection with the summer sores noted later, tartar emetic is recommended. These worms have an intermediate stage in the ordinary housefly or other flies, biting and nonbiting, the fly becoming infected while it is a larva developing in horse manure. Obviously, therefore, any measures looking toward the eradication of the fly or the proper disposal of manure will aid in the control and eradication

of this worm. The United States Bureau of Entomology and Plant Quarantine has shown that fly maggots travel downward through a manure pile as it comes time for the maggot to enter the ground and pupate, and an excellent maggot trap, consisting of an exposed manure platform raised on posts set in a concrete basin extending under the platform and filled with 3 or 4 inches of water, has been devised. As maggots work down they come to the platform and escape through the spaces between the boards, left open for the purpose, to the water in the concrete basin, where they are drowned. In this way the exposed manure pile serves to attract flies with a deceptive proffer of a breeding place.

The young forms of these stomach worms develop at times in the skin, causing a cutaneous habronemiasis known as summer sores. This is discussed under diseases of the skin.

STRONGYLES (STRONGYLUS SPP. AND CYATHOSTOMINAE SPP.)

These worms (pl. V, figs. 2 and 3) live in the large intestines of the horse as adult worms and are often present in enormous numbers. Many of them are very small, and the largest are less than 2 inches long. The adult worms do considerable damage, but the immature or larval worms do even more.

The larva of *Strongylus vulgaris* enters the blood vessels of the intestinal wall and finally attaches in the great mesenteric artery, where it causes aneurisms; here it transforms to an adult without mature sexual organs. This occurrence may be fortuitous. The worms may normally pass directly to the walls of the cecum and colon and encyst, giving rise to small cysts or abscesses; these cysts finally discharge to the interior of the cecum, setting the worms, now mature, at liberty in the lumen of the intestines.

The larvae of *Strongylus equinus* are found principally in the liver, lungs, and pancreas.

The larvae of *Strongylus edentatus* may be found almost anywhere, especially under the serous membranes, the pleura, and peritoneum.

The embryos and larvae of species of *Cyathostominae* are found in the mucosa of the large intestine.

Aneurisms impede the circulation of the blood and may give rise to intermittent lameness. The aneurism may rupture, since it constitutes a weak place in the wall of the blood vessel, and the horse dies of the resulting hemorrhage. Particles of blood clots in the aneurisms may break off and plug a blood vessel at the point where they lodge, thereby causing the death of the part from which the blood is shut off and occasioning a type of colic that often terminates fatally. The larvae of *Cyathostominae* form cysts in the walls of the large intestine, and when these open they give rise to small sores;

when they are numerous they cause a thickening and hardening that impair the proper functioning of the intestine. Abscesses sometimes perforate, causing death. The adult worms of some species attack the intestinal wall, causing bleeding that results in anemia. The numerous small sores thus caused allow bacteria to get into the circulation, sometimes resulting in localized abscesses or in septic arthritis or joint disease.

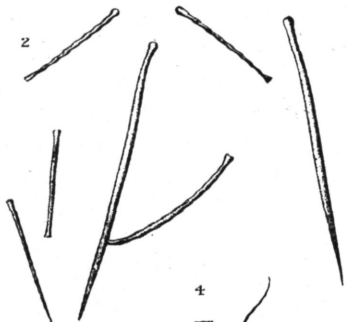
The disease due to these worms is common. The worms enter the body as immature forms. Most of these are picked up in the spring, when the animal is turned out on pasture. The first symptoms often show in November or December, the disease being in a latent stage during the development of the worms. The usual symptoms are diarrhea, loss of appetite, and emaciation. The animal becomes anemic. Secondary symptoms are edema and such complications as joint infection, colic due to embolism, and accidents from falls, hemorrhage from ruptured aneurisms, or perforation at the site of abscess. The animal may die, recover, or become a chronic sufferer, the internal injuries failing to make a satisfactory recovery even with the removal of the worms in chronic cases.

Treatment for the expulsion of these worms from the intestinal tract consists in the administration of oil of chenopodium or carbon tetrachloride after a suitable period of fasting. Both drugs are very effective for the expulsion of large strongyles (*Strongylus* spp.). Carbon tetrachloride is less effective for the removal of species of *Cyathostominae* than is oil of chenopodium. Phenothiazine, a new anthelmintic, is more effective than either of the above drugs for the removal of all species of strongyles, but its use in horses is still in an experimental stage. There are certain conditions in the presence of which these drugs should not be employed. Also improper administration of the drugs may lead to serious injury to horses. In view of these facts, these treatments should be administered by a competent veterinarian. Following removal of the adult worms, it is advisable, particularly in severe cases of anemia resulting from worm infestation, to administer drugs such as ferrous sulfate or sodium cacodylate in order to stimulate blood regeneration. The various complications of bacterial infection, colic, heart depression, etc., call for the attention of a veterinarian. Preventive measures consist in avoiding reinfection with worms as far as possible by using dry upland pasture in preference to low, wet land, and by rotating pastures or rotation of the stock on a given pasture. Horses may be alternated with cattle, sheep, or hogs to advantage, as far as parasites are concerned. Another feature, always of importance, is the provision of pure drinking water.

Oxyuris equi



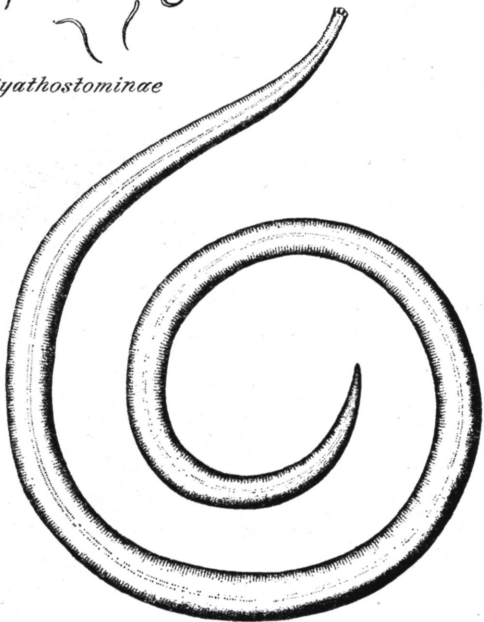
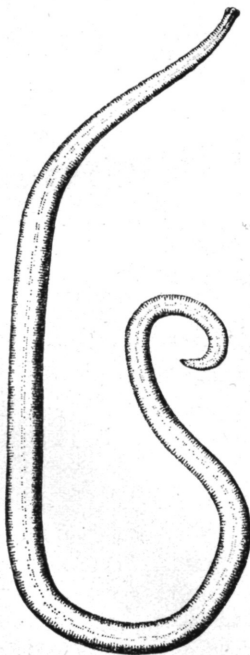
Strongylus equinus.



Habronema microstoma

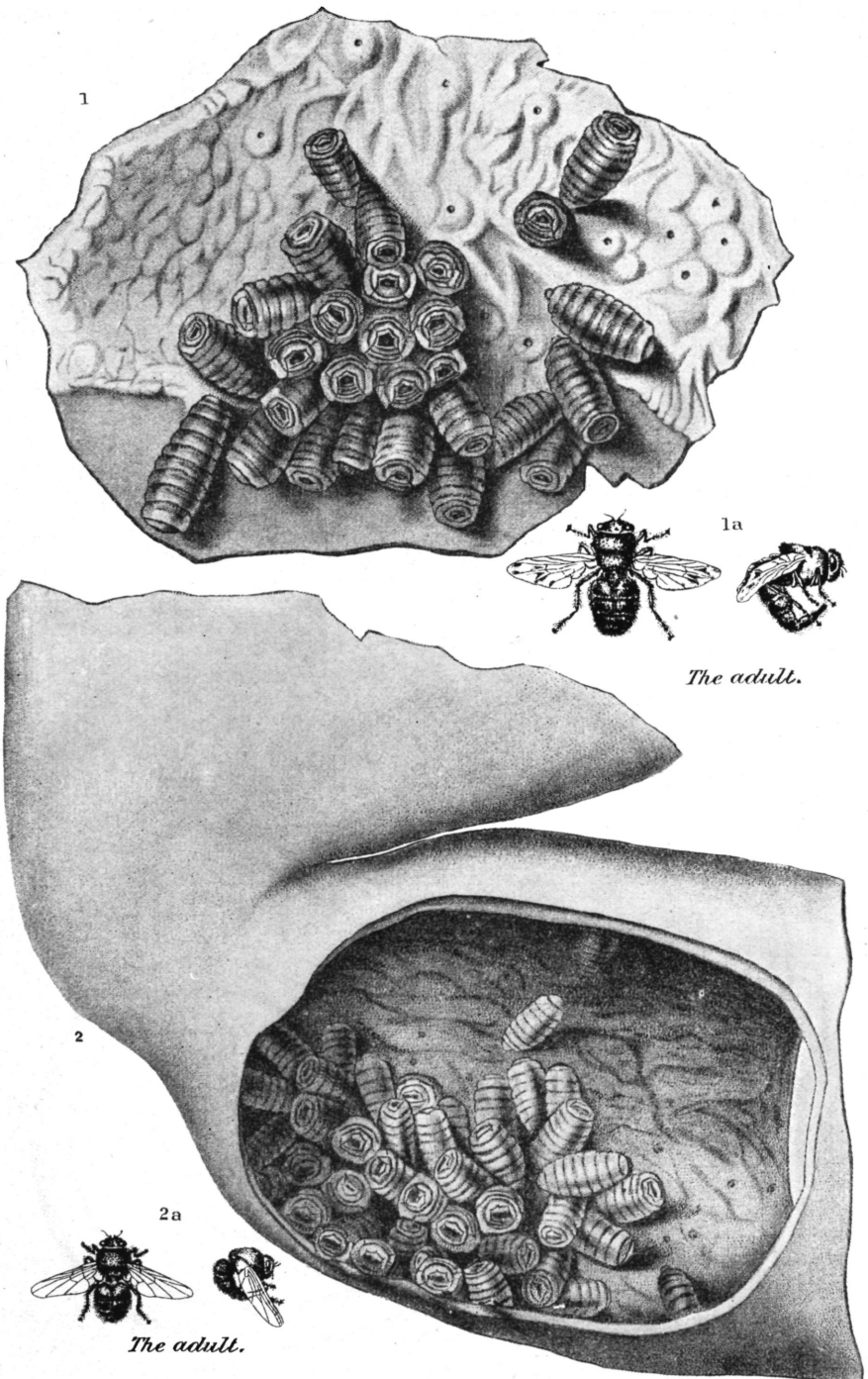


Cyathostominae



Ascaris equorum

Haines, del.



BOTS.

- 1, Bots in the stomach.
2, Bots in the duodenum.

BOTS (*GASTROPHILUS* SPP.)

Bots (pl. VI) are common in the stomach and upper part of the small intestine of the horse anywhere in the United States, one kind being occasionally found in the rectum. They attach to that portion of the mucous lining of the stomach nearest the esophagus or sometimes around the pyloric opening to the intestine or even in the upper intestine and undoubtedly interfere with the proper functioning of the stomach and the health of the animal to a certain extent. The symptoms are rather vague as a rule, but the general result is a condition of unthriftiness.

The most effective treatment for the removal of bots consists in the administration, after an 18-hour fast, of carbon disulfide in a dose of 6 fluid drams (24 cubic centimeters) for an animal weighing 1,000 pounds. This drug may be administered in capsules or by stomach tube, the latter being the preferred method. The improper administration of this drug may lead to serious injury or even death in horses. For this reason, the drug should always be administered by a competent veterinarian.

Unless destroyed by treatment, the bots in the stomach of the horse pass out in the manure in the spring and burrow down into the soil an inch or two. Here they undergo a certain amount of development and finally emerge as adult flies. These bot flies mate and during the summer the eggs are deposited by the female on the forelegs and shoulders or around the chin, mouth, and nostrils of the horse, the location and appearance of the eggs varying somewhat with different species of bot flies. The young maggots escaping from the eggs are ingested by the horse in licking the portions irritated by the movement of the escaping maggots and when swallowed develop to form bots in the stomach. More or less recent investigations have shown that the newly hatched bots do not pass directly into the stomach, but burrow into the mucosa of the tongue and cheeks, the burrowing movement producing considerable irritation. Approximately one month elapses from the time that the tiny maggots are taken into the mouth until they reach the stomach. Careful currying, especially around the forequarters, is an aid in keeping down bot infestation, but this is not commonly feasible with horses on pasture, the ones most likely to become infested.

Diseases of the Respiratory Organs

By W. H. HARBAUGH, V. S.

[Revised by GILBERT T. CREECH, D. V. S.]

The organs pertaining to the respiratory function are enumerated in their natural order as follows: The nasal openings, or nostrils; the nasal chambers, through which the air passes in the head; the sinuses in the head, communicating with the nasal chambers; the pharynx, common to the functions of breathing and swallowing; the larynx, at the top of the windpipe; the trachea, or windpipe; the bronchi (into which the windpipe divides), two tubes leading from the windpipe to the right and left lungs, respectively; the branches of the bronchial tubes, which penetrate and convey air to all parts of the lungs; the lungs.

The pleura is a thin membrane that envelops the lung and lines the walls of the thoracic cavity. The diaphragm is a muscular structure, completely separating the thoracic cavity from the abdominal cavity. It is essentially a muscle of inspiration, and the principal one. Other muscles aid in the mechanism of respiration, but the diseases or injuries of them have nothing to do with the diseases under consideration.

Just within the nasal openings the skin becomes gradually but perceptibly finer, until it is succeeded by the mucous membrane. Near the junction of the skin and membrane is a small hole, having the appearance of being made with a punch; this is the opening of the lachrymal duct, a canal that conveys the tears from the eyes. Within and above the nasal openings are the cavities, or fissures, called the false nostrils. The nasal chambers are completely separated, the right from the left, by a cartilaginous partition, the nasal septum. Each nasal chamber is divided into three continuous compartments by two thin, scroll-like turbinated bones.

The mucous membrane lining the nasal chambers, and, in fact, the entire respiratory tract, is much more delicate and more frequently diseased than the mucous membrane of any other part of the body. The sinuses of the head are compartments that communicate with the nasal chambers and are lined with a continuation of the same membrane that lines the nasal chambers; their presence increases the volume and modifies the form of the head without increasing its weight.

The horse, in a normal condition, breathes exclusively through the nostrils. The organs of respiration are likely to become diseased, and, as many of the causes that lead to these attacks can be avoided, it is both important and profitable to know and study the causes.

CAUSES OF DISEASES OF RESPIRATORY ORGANS

The causes of many of the diseases of these organs may be given under a common head, because even a simple cold, if neglected or badly treated, may run into the most complicated lung disease and terminate fatally. In the spring and fall, when the animals are changing their coats, there is a marked predisposition to contract disease, and consequently at those periods care should be taken to prevent other exciting causes.

Badly ventilated stables are a frequent source of disease. It is a mistake to think that country stables necessarily have purer air than city stables. Stables on some farms are so faultily constructed that it is almost impossible for the foul air to gain an exit. All stables should have a sufficient supply of pure air and be so arranged that strong drafts cannot blow directly on the animals. In ventilating a stable, it is best to arrange to remove air from near the floor and admit it through numerous small openings near the ceiling. In summer, top exits and cross currents should be provided to remove excessive heat. Hot stables are almost always poorly ventilated, and a hot stable is a cause of disease on account of the extreme change of temperature that a horse is liable to when taken out, and extreme changes of temperature are to be avoided as certain causes of disease.

A cold, close stable is invariably damp and is to be avoided as much as the hot, close, and foul one. Pure air is more essential than warmth, and this fact should be especially remembered when the stable is made close and foul to gain the warmth. It is better to keep the horse warm with blankets than to shut out pure air in order to make the stable warm.

Stables should be well drained and kept cleaned. Some farmers allow large quantities of manure to accumulate in the stable. This is a pernicious practice, as the decomposing organic matter evolves gases that are predisposing or exciting causes of disease. When a horse is overheated, it is not safe to allow the animal to dry by evaporation; rubbing it dry and gradually cooling it is the wisest treatment. When a horse is hot and covered with sweat, it is dangerous to allow the animal to stand in a draft; the best plan is to make it walk until the temperature moderates. In such cases a light blanket thrown over the animal may prevent a cold. Overwork or over-exertion often causes fatal cases of congestion of the lungs. Avoid prolonged or fast work when the horse is out of condition or unac-

customed to it. Animals that have been working in cold rains should be dried and cooled and not left to dry by evaporation. When the temperature of the weather is at the extreme, either of heat or cold, diseases of the organs of respiration are most frequent.

It is not to be supposed that farmers can give their horses the particular attention given to valuable racing and pleasure horses, but they can most assuredly give them common-sense care, and this may often save the life of a valuable animal.

WOUNDS ABOUT THE NOSTRILS

Wounds in the region of the nostrils are common and are generally caused by snagging on a nail or splinter, by the bite of another horse, by getting run into, or by running against something. Occasionally the nostril is so badly torn and lacerated that it is impossible to effect a cure without leaving the animal blemished for life, but in most instances the blemish, or scar, is the result of poor treatment of the wound. As soon as possible after the accident the parts should be brought together and held there by stitches. If too much time is allowed to elapse, the swelling of the parts will considerably interfere. Never cut away any skin that may be loose and hanging, or a scar will certainly remain. Bring the parts directly together and place the stitches from a quarter to a half inch apart, as circumstances may demand. It is not necessary to have a special surgeons' silk and needles for this operation; good linen thread or ordinary silk thread will answer. The wound afterwards needs only to be kept clean. For this purpose it should be cleansed and discharges washed away daily with a solution made of carbolic acid 1 part in 40 parts of water. If on account of the irritability the horse is inclined to rub the wound against some object, his head should be tied by means of two halter ropes attached to the opposite sides of the stall, to prevent him from opening the wound. Except when at work or eating, the head should be so tied about 10 days.

TUMORS WITHIN THE NOSTRILS

A small, globular tumor is sometimes found within the false nostril, under that part of the skin that is seen to puff or rise and fall when a horse is exerted and breathing hard. These tumors may contain a cheeselike substance.

Treatment.—If the tumor is well opened and the contents squeezed out, nature will perform a cure. If the opening is made from the outside through the skin, it should be at the most dependent part, but much the best way to open the tumor is from the inside. Quiet the animal, gently insert the finger up in the direction of the tumor, and you will soon discover that it is much larger inside than it appears to

be on the outside. If necessary put a twitch on the ear of the horse to quiet him; run the index finger of the left hand against the tumor; now, with the right hand, carefully insert the knife by running the back of the blade along the index finger of the left hand until the tumor is reached; with the left index finger guide the point of the blade quickly and surely into the tumor; make the opening large. A little blood may flow for a while, but it is of no consequence. Squeeze out the puslike material and keep the part clean.

COLD IN THE HEAD (NASAL CATARRH)

Catarrh is an inflammation of a mucous membrane. It is accompanied with excessive secretion. In nasal catarrh the inflammation may extend from the membrane lining the nose to the throat, the inside of the sinuses, and to the eyes. The causes are the general causes of respiratory disease already enumerated. It is especially common in young horses and in horses not acclimated.

Symptoms.—The membrane at the beginning of the attack is dry, congested, and irritable; it is of a deeper hue than natural, pinkish red or red. Soon a watery discharge from the nostrils makes its appearance; the eyes may also be more or less affected and tears flow over the cheeks. The animal has some fever, which may be easily detected by means of a clinical thermometer inserted in the rectum or, roughly, by placing the finger in the mouth, as the feeling of heat conveyed to the finger will be greater than natural.

To become somewhat expert in ascertaining the changes of temperature in the horse it is necessary only to place the finger often in the mouths of horses known to be healthy. After one has become accustomed to the warmth of the mouth of the healthy animal he will have no difficulty in detecting a marked increase of the temperature. The animal may be dull; it sneezes or snorts but does not cough unless the throat is affected; it expels the air forcibly through the nostrils, often in a manner that may be aptly called "blowing the nose." A few days after the attack begins the discharge from the nostrils changes from a watery to a thick, mucilaginous state, of a yellowish-white color, and may be more or less profuse. Often the appetite is lost and the animal becomes debilitated.

Treatment.—This disease is not serious, but inasmuch as neglect or bad treatment may cause it to lead to something worse or become chronic it should receive proper attention. The animal should not be worked for a time. A few days of rest, with pure air and good feed, will be of greater benefit than most medication. The value of pure air cannot be overestimated, but drafts must be avoided. The benefit derived from the inhalation of steam is considerable. This is effected by holding the horse's head over a bucketful of boiling

water, so that the animal will be compelled to inhale steam with every inhalation of air. Stirring the hot water with a wisp of hay causes the steam to arise in greater abundance. Another method is to put the horse's nose in a bag containing cut hay upon which hot water has been poured, the bottom of the bag being placed in a bucket, but the bag must be of loose texture, such as gunny sack. If the bag is of canvas, holes must be cut in the side to admit fresh air.

The horse may be made to inhale steam four or five times a day, about 15 or 20 minutes each time.

Particular attention should be paid to the diet. Give bran mashes, scalded oats, linseed gruel, and grass, if in season. If the horse evinces no desire for this soft diet, it is better to allow any kind of feed that the animal will eat, such as hay, oats, or corn, than to keep it on short rations.

If the animal is constipated, relieve this symptom by injections (enemas) of warm water into the rectum three or four times a day, but do not administer purgative medicines, except of a mild character.

For simple cases the foregoing is all that is required, but if the appetite is lost and the animal appears debilitated and dull, a veterinarian should be called to examine the animal and give appropriate treatment.

If the weather is cold, blanket the animal and keep it in a comfortable stall. If the throat is sore, treat as advised for that ailment, to be described hereafter.

If, after 10 days or 2 weeks, the discharge from the nostrils continues, give one-half dram of reduced iron three times a day. This may be mixed with damp feed. A common cold should be intelligently treated in order to prevent more dangerous diseases.

CHRONIC CATARRH (NASAL GLEET, OR COLLECTION IN THE SINUSES)

This is a subacute or chronic inflammation of some part of the membrane affected in common cold, the disease just described. It is manifested by a persistent discharge of a thick white or yellowish-white pus from one or both nostrils. The commonest cause is a neglected or badly treated cold, and it usually follows those cases in which the horse has suffered exposure, been overworked, or has not received proper feed, and, as a consequence, has become debilitated. It may occur as a sequel to influenza.

Other but less frequent causes for this affection are: Fractures of the bones that involve the membrane of the sinuses, and even blows on the head over the sinuses. Diseased teeth often involve a sinus and cause a fetid discharge from the nostril. Violent coughing is said to have forced particles of feed into the sinus, which acted as a cause of the disease. Tumors growing in the sinuses are known to

have caused it. It is also attributed to disease of the turbinated bones. Absorption of the bones forming the walls of the sinuses has been caused by the pressure of pus collected in them and by tumors filling the cavity.

Symptoms.—Great caution must be exercised when examining these cases for the horse may have glanders, whereas, on the other hand, horses have been condemned for glanders when really nothing ailed them but nasal gleet. This is not contagious but may stubbornly resist treatment and last for a long time. In most cases the discharge is from one nostril only, which may signify that the sinuses on that side of the head are affected. The discharge may be intermittent; that is, quantities may be discharged at times and again little or none for a day or so. Such an intermittent discharge usually signifies disease of the sinuses. The glands under and between the bones of the lower jaw may be enlarged. The peculiar ragged-edged ulcer of glanders is not to be found on the membrane within the nostrils, but occasionally sores are to be seen there. If there is any doubt about it the opinion of a competent veterinarian should be obtained.

The eye on the side of the discharging nostril may have a peculiar appearance and look smaller than the other. There may be an enlargement, having the appearance of a bulging out of the bone over the part affected, between or below the eyes. The breath may be offensive, which indicates decomposition of the pus or bones or disease of the teeth. A diseased tooth is further indicated by the horse's holding its head to one side when eating, or by dropping the feed from the mouth after partly chewing it. When the bones between the eyes, below the eyes, and above the back teeth of the upper jaw are tapped on, a hollow, drumlike sound is emitted, but if the sinus is filled with pus or contains a large tumor the sound emitted will be the same as if a solid substance were struck; by this means the affected sinus may be located in some instances. The hair may be rough over the affected part, or even the bone may be soft to the touch and an impression may be left on the part when it is pressed on with the finger.

Treatment.—The cause of the trouble must be ascertained before treatment is commenced. If the animal is in poor condition, it should have very nutritious feed and regular exercise. The feed or box containing it should be placed on the ground, as the lowered position of the head favors the discharge.

Animals that do not require a surgical operation must, as a rule, have persistent medicinal treatment. Certain tonics and local medication may be prescribed by the attending veterinarian. Chloride of lime may be sprinkled around the stall. Keep the nostrils washed and the discharge cleaned away from the manger and stall. The

horse may be made to inhale the vapor of compound tincture of benzoin by pouring 2 ounces of this drug into hot water and fumigating in the usual way.

If the nasal gleet is the result of a diseased tooth, the latter must be removed. Trephining is the best way to remove it in such cases, as the operation immediately opens the cavity, which can be attended to direct. In all those cases of nasal gleet in which sinuses contain either tumors or collections of pus the only relief is by the trephine; this is an operation that should be performed only by a competent veterinarian.

An abscess involving the turbinated bones is similar to the collection of pus in the sinuses and must be relieved by trephining.

THICKENING OF THE NASAL MEMBRANE

This is sometimes denoted by a chronic discharge, a snuffling in the breathing, and a contraction of the nostril. It is a result of common cold and requires the same treatment as prescribed for chronic catarrh namely, ferrous sulfate, copper sulfate, potassium iodide, etc. The membranes of both sides may be affected, but one side only is the rule; the affected side may be easily detected by holding the hand tightly over one nostril at a time. When the healthy side is closed in this manner, the difficult breathing through the affected side will demonstrate a decreased size of the nasal cavity or an obstruction.

NASAL POLYPUS

Tumors with narrow bases (somewhat pear-shaped) are occasionally attached to the membrane of the nasal chambers and are obstructions to breathing through the side in which they are located. They vary much in size; some are so small that their presence is not manifested, whereas others almost completely fill the chamber, thereby causing a serious obstruction to the passage of air. The stem, or base, of the tumor is generally attached high in the chamber, and usually the tumor cannot be seen, but occasionally it increases in size until it can be observed within the nostril. Sometimes, instead of hanging down toward the nasal opening, it falls back into the pharynx. It causes a discharge from the nostril, a more or less noisy snuffling sound in breathing, according to its size, a discharge of blood (if it is injured), and sneezing. The side that it occupies can be detected in the same way as described for the detection of the affected side when the breathing is obstructed by a thickened membrane.

The only relief is removal of the polypus, which, like all other operations, should be done by a competent veterinarian. The operation is performed by grasping the base of the tumor with suitable forceps and twisting it round and round until it is torn from its attach-

ment, or by cutting it off with a noose of wire. The resulting hemorrhage is checked by the use of an astringent lotion, such as a solution of the tincture of ferric chloride, or by packing the nostrils with surgeon's gauze.

PHARYNGEAL POLYPUS

This is exactly the same kind of tumor described as nasal polypus, the only difference being in the situation. Indeed, the stem of the tumor may be attached to the membrane of the nasal chamber, as before explained, or it may be attached in the fauces (opening of the back part of the mouth), and the body of the tumor then falls into the pharynx. In this situation it may interfere seriously with breathing. Sometimes it drops into the larynx and causes alarming symptoms. The animal coughs or tries to cough, saliva flows from the mouth, the breathing is performed with the greatest difficulty and accompanied with a loud noise; the animal appears as if strangled and often falls exhausted. When the tumor is coughed out of the larynx the animal regains its strength quickly and soon appears as if nothing were ailing. These sudden attacks and quick recoveries point to the nature of the trouble. The examination must be made by holding the animal's mouth open with a balling iron or speculum and running the hand back into the mouth. If the tumor is within reach, it must be removed in the same manner as though it were in the nose.

BLEEDING FROM THE NOSE

This often occurs during the course of diseases such as influenza, bronchitis, purpura hemorrhagica, and glanders. But it also occurs independently of other affections and, as before mentioned, is a symptom of polypus, or tumor, in the nose.

Injuries to the head, exertion, violent sneezing—causing a rupture of a small blood vessel—also induce it. The bleeding is usually from one nostril only and is never very serious. The blood escapes in drops (seldom in a stream) and is not frothy, as when the hemorrhage is from the lungs. (See Bleeding from the Lungs, p. 109.) In most cases bathing the head and washing out the nostril with cold water are all that is necessary. If the cause is known it should be removed if possible. If the bleeding continues, pour ice-cold water over the face, between the eyes and down over the nasal chambers. A bag containing ice in small pieces applied to the head is often efficient. If in spite of these measures the hemorrhage continues, plugging the nostrils with cotton, tow, or oakum should be tried. A string should be tied around the plug before it is pushed up into the nostril, so that it can be safely withdrawn after 4 or 5 hours. If both nostrils are bleeding, only one nostril at a time should be plugged. If the hemorrhage is profuse and persistent, a veterinarian should be called immediately.

INFLAMMATION OF THE PHARYNX

As already stated, the pharynx is common to the functions of both respiration and swallowing. From this organ the air passes into the larynx and thence onward to the lungs. In the posterior part of the pharynx is the superior extremity of the gullet, or esophagus, the canal through which the feed and water pass to the stomach. Inflammation of the pharynx is usually a complication of diseases such as influenza and strangles and is probably always more or less complicated with inflammation of the larynx. That it may exist as an independent affection there is no reason to doubt, and it is discussed as such with the diseases of the digestive tract.

SORE THROAT, OR LARYNGITIS

The larynx is situated in the space between the lower jawbones just back of the root of the tongue. It may be considered as a box (somewhat depressed on each side), composed principally of cartilages and small muscles, and lined on the inside with a continuation of the respiratory mucous membrane. Posteriorly it opens into and is continuous with the windpipe. It is the organ of the voice, the vocal cords being situated within it; but in the horse this function is of little consequence. It dilates and contracts to a certain extent, thus regulating the volume of air passing through it. The mucous membrane lining it internally is so highly sensitive that if the smallest particle of feed drops into it from the pharynx violent coughing ensues instantly and is continued until the source of irritation is ejected. This is a provision of nature to prevent foreign substances gaining access to the lungs. That projection called Adam's apple in the neck of man is the prominent part of one of the cartilages forming the larynx.

Inflammation of the larynx is a serious and sometimes-fatal disease, and, as previously stated, is usually complicated with inflammation of the pharynx, constituting what is popularly known as sore throat. The chief causes are chilling and exposure.

Symptoms.—About the first symptom noticed is a cough, followed by difficulty in swallowing, which may be due to soreness of the membrane of the pharynx, over which the feed or water must pass, or from the pain caused by the contraction of the muscles necessary to impel the feed or water onward to the gullet; or this same contraction of the muscles may cause a pressure on the larynx and produce pain. In many instances the difficulty in swallowing is so great that water, and in some cases feed, is returned through the nose. This, however, does not occur in laryngitis alone, but only when the pharynx is involved in the inflammation. The glands between the lower jawbones and below the ears may be swollen. Pressure on the larynx induces coughing. The head is more or less "poked out," or extended

and has the appearance or being stiffly carried. The membrane in the nose becomes red. A discharge from the nostrils soon appears. As the disease advances, the breathing may assume a more or less noisy character; sometimes a harsh, rasping snore is emitted with every respiration, the breathing becomes hurried, and occasionally the animal seems threatened with suffocation.

Treatment.—In all cases steam the nostrils, as has been advised for cold in the head. In bad cases cause the steam to be inhaled continuously for hours—until relief is afforded. Have a bucketful of fresh boiling water every 15 or 20 minutes. In each bucketful of water put a tablespoonful of oil of turpentine or compound tincture of benzoin, the vapor of which will be carried along with the steam to the affected parts and have a beneficial effect. In mild cases steaming the nostrils five, six, or seven times a day will suffice.

The animal should be placed in a comfortable, dry stall (a box stall preferred), and should have pure air to breathe. The body should be blanketed, and bandages applied to the legs. The diet should consist of soft feed—bran mash, scalded oats, linseed gruel, and, best of all, fresh grass, if in season. The manger, or trough, should be neither too high nor too low, but a temporary one should be constructed at about the height that the animal carries its head. Having to reach too high or too low may cause so much pain that the animal would rather forego satisfying what little appetite it may have than inflict pain by craning the head for feed or water. A supply of fresh water should be before the horse all the time; the animal will not drink too much nor will the cold water hurt it. Constipation, if present, must be relieved by enemas of warm water, administered 3 or 4 times during the 24 hours.

A liniment composed of 2 ounces of olive oil and 1 each of solution of ammonia and tincture of cantharides, well shaken together, may be thoroughly rubbed in about the throat from ear to ear, and about 6 inches down over the windpipe, and in the space between the lower jaws. This liniment should be applied once a day for 2 or 3 days.

If the animal is breathing with great difficulty, persevere in steaming the nostrils, and dissolve 2 drams of potassium chlorate in every gallon of water that the animal drinks; even if much of it cannot be swallowed and is returned through the nostrils, it will be of some benefit to the pharynx as a gargle. An electuary of potassium acetate, 2 drams, honey, and licorice powder may be spread on the teeth with a paddle every few hours.

When the breathing begins to be loud, relief is afforded in some cases by giving a drench composed of 2 drams of fluid extract of *Jaborandi* in half a pint of water. If benefit is derived, this drench

may be repeated 4 or 5 hours after the first dose is given. It will cause a free flow of saliva from the mouth.

In urgent cases, when suffocation seems inevitable, the operation of tracheotomy must be performed. To describe this operation in words that would make it comprehensible to the general reader is a more difficult task than performing the operation, which, in the hands of the expert, is simple and attended with little danger. The layman should not undertake this operation if it is at all possible to obtain a veterinarian.

The operator should be provided with a tracheotomy tube (to be purchased from any surgical supply house) and a sharp knife, a sponge, and a bucket of clean cold water. The place to be selected for opening the windpipe is that part which is found, upon examination, to be least covered with muscles, about 5 or 6 inches below the throat. Right here, then, is the place to cut through. Have an assistant hold the animal's head still. Grasp the knife firmly in the right hand, select the spot, and make the cut from above to below directly on the median line on the anterior surface of the windpipe. Make the cut about 2 inches long in the windpipe; this necessitates cutting three or four rings. One bold stroke is usually sufficient, but if it is necessary to make several other cuts to finish the operation, do not hesitate. The purpose is to make a hole in the windpipe sufficiently large to admit the tracheotomy tube. It is quickly manifested when the windpipe is severed; the hot air rushes out, and when air is taken in it is sucked in with a noise. A slight hemorrhage may result, which is easily controlled by washing the wound with a sponge and cold water, but care must be used not to get any water in the windpipe. Instruct the assistant to hold the head down immediately after the operation, so that the neck will be in a horizontal line. This will prevent the blood from getting into the windpipe and will allow it to drop directly on the ground. If you have the self-adjustable tube, it retains its place in the wound without further trouble after it is inserted. The other kind must be secured in position by means of two tapes or strings tied around the neck. After the hemorrhage is somewhat abated, sponge the blood away and see that the tube is thoroughly clean, then insert it, directing the tube downward toward the lungs.

The immediate relief this operation affords is gratifying. The animal, a few minutes before on the verge of death from suffocation, emitting a loud wheezing sound with every breath, with haggard countenance, body swaying, pawing, gasping, fighting for breath now breathes tranquilly, and may be in search of something to eat.

The tube should be removed once a day and cleaned with a solution of carbolic acid, 1 part to 20 parts of water, and the discharge washed

away from the wound with a solution of carbolic acid, 1 part to 40 parts of water. Several times a day the hand should be held over the opening in the tube to test the animal's ability to breathe through the nostrils, and as soon as it is demonstrated that breathing can be performed in the natural way the tube should be removed, the wound thoroughly cleansed with a solution of carbolic acid, 1 part to 40 parts of water, and closed by inserting four or five stitches through the skin and muscle. Do not include the cartilages of the windpipe in the stitches. Apply the solution to the wound three or four times a day until healed. When the tube is removed to clean it, the lips of the wound may be pressed together to ascertain whether or not the horse can breathe through the larynx. The use of the tube should be discontinued as soon as possible.

Tracheotomy tubes are seldom to be found on farms, and especially when most urgently required. In such instances, with a strong needle pass a waxed end or other strong string through each side of the wound, including the cartilage of the windpipe, and keep the wound open by tying the strings over the neck.

During the time the tube is used the other treatment advised must not be neglected. After a few days the discharge from the nostrils becomes thicker and more profuse. This is a good symptom and signifies that the acute stage has passed. At any time during the attack, if the horse becomes weak, give aromatic spirits of ammonia, 2 ounces in water. Do not be in a hurry to put the animal back to work, but give plenty of time for a complete recovery. Gentle and gradually increasing exercise may be given as soon as the horse is able to stand it. The feed should be carefully selected and of good quality. Tonics, consisting of iron preparations or arsenic, may be given.

If abscesses form in connection with the disease they must be opened to allow the escape of pus, but do not rashly plunge a knife into swollen glands; wait until it is certain that the swelling contains pus. The formation of pus may be encouraged by the constant application of poultices for hours at a time. The best poultice for the purpose is made of linseed meal, with sufficient hot water to make a thick paste. If the glands remain swollen for some time after the attack, rub well over them an application of the following: Biniodide of mercury, 1 dram; lard, 1 ounce; mix well. This may be applied once every day until the part is blistered.

Sore throat is also a symptom of other diseases, such as influenza, strangles, and purpura hemorrhagica, which diseases may be consulted under their proper headings.

After a severe attack of inflammation of the larynx the mucous membrane may be left in a thickened condition, or an ulceration of the part may ensue, either of which is likely to produce a chronic

cough. For the ulceration it is useless to prescribe, because it can neither be diagnosed nor treated by the nonprofessional.

If a chronic cough remains after all the other symptoms have disappeared, it is advisable to give 1 dram of potassium iodide dissolved in a bucketful of drinking water, 1 hour before feeding, three times a day for a month if necessary. Also rub in well the preparation of mercuric iodide (as advised for the swollen glands) about the throat, from ear to ear, and in the space between the lower jawbones. The application may be repeated every third day until the part is blistered.

SPASM OF THE LARYNX

The symptoms are as follows: Sudden attack of a violent fit of coughing; the horse may reel and fall, and after a few minutes recover and be well as ever. The treatment recommended is as follows: Three drams of potassium bromide three times a day, dissolved in the drinking water or given as a drench in about a half pint of water for a week. Then give 1 dram of powdered nux vomica (either on the feed or shaken with water as a drench) once a day for a few weeks.

CROUP AND DIPHTHERIA

Neither of these diseases affects the horse, but these names are sometimes wrongly applied to severe laryngitis or pharyngitis or to similar conditions, in which the throat is paralyzed and becomes excessively inflamed and gangrenous.

THICK WIND AND ROARING

Horses that are affected with chronic disease that causes a loud, unnatural noise in breathing are said to have thick wind, or to be roars. This class does not include those affected with severe sore throat, as in these animals the breathing is noisy only during the attack of the acute disease.

Thick wind is caused by an obstruction to the free passage of the air in some part of the respiratory tract. Nasal polypi, thickening of the membrane, pharyngeal polypi, deformed bones, and paralysis of the wing of the nostril, are occasional causes. The noisy breathing of horses after having been idle and put to sudden exertion is not due to any disease and is only temporary. Very often a nervous, excitable horse will make a noise for a short time when started off, generally caused by the cramped position in which the head and neck are forced in order to hold the animal back.

Many other causes may occasion temporary, intermittent, or permanent noisy respiration, but chronic roaring is caused by paralysis of the muscles of the larynx; and almost invariably the muscles of the left side of the larynx are the ones affected.

In chronic roaring the noise is made when the air is drawn into the lungs; only when the disease is far advanced is a sound produced when the air is expelled, and even then it is not nearly so loud as during inspiration.

In a normal condition the muscles dilate the aperture of the larynx by moving the cartilage and vocal cord outward, allowing a sufficient volume of air to rush through. But when the muscles are paralyzed the cartilage and vocal cord that are normally controlled by the affected muscles lean into the tube of the larynx, so that when the air rushes in it meets this obstruction and the noise is produced. When the air is expelled from the lungs its very force pushes the cartilage and vocal cords out, and consequently noise is not produced in the expiratory act.

The paralysis of the muscles is due to derangement of the nerve that supplies them with energy. The muscles of both sides are not supplied by the same nerve; there is a right and a left nerve, each supplying its respective side. The fact that the muscles on the left side are the ones usually paralyzed is due to the difference in the anatomical arrangement of the nerves. The left nerve is much longer and more exposed to interference than the right nerve.

In chronic roaring there is no evidence of any disease of the larynx other than the wasted condition of the muscles in question. The disease of the nerve is generally far from the larynx. Disease of parts contiguous to the nerve along any part of its course may interfere with its proper function. Enlargement of lymphatic glands within the chest through which the nerve passes on its way back to the larynx is the most frequent interruption of nervous supply, and consequently results in roaring. When roaring becomes confirmed, medicinal treatment is entirely useless, as it is impossible to restore the wasted muscle and at the same time remove the cause of the interruption of the nervous supply. Before roaring becomes permanent the condition may be benefited by a course of potassium iodide, if caused by disease of the lymphatic glands. The operation of extirpating the collapsed cartilage and vocal cord is believed to be the only relief, and, as this operation is critical and can be performed only by the skillful veterinarian, it will not be described here.

From the foregoing description of the disease it will be seen that the name "roaring," by which the disease is generally known, is only a symptom and not the disease. Chronic roaring is also in many cases accompanied with a cough. The best way to determine whether a horse is a "roarer" is either to make it pull a load rapidly up a hill or over a sandy road or soft ground, or, if it is a saddle horse, gallop it up a hill or over soft ground. The object is to make the animal exert itself. Some horses require a great deal more exertion

than others before the characteristic sound is emitted. The greater the distance the horse is forced, the more exhausted it will appear if it is a roarer; in bad cases the animal becomes utterly exhausted, the breathing is rapid and difficult, the nostrils dilate to the fullest extent, and the animal appears as if suffocation were imminent.

An animal that is a roarer should not be used for breeding purposes.

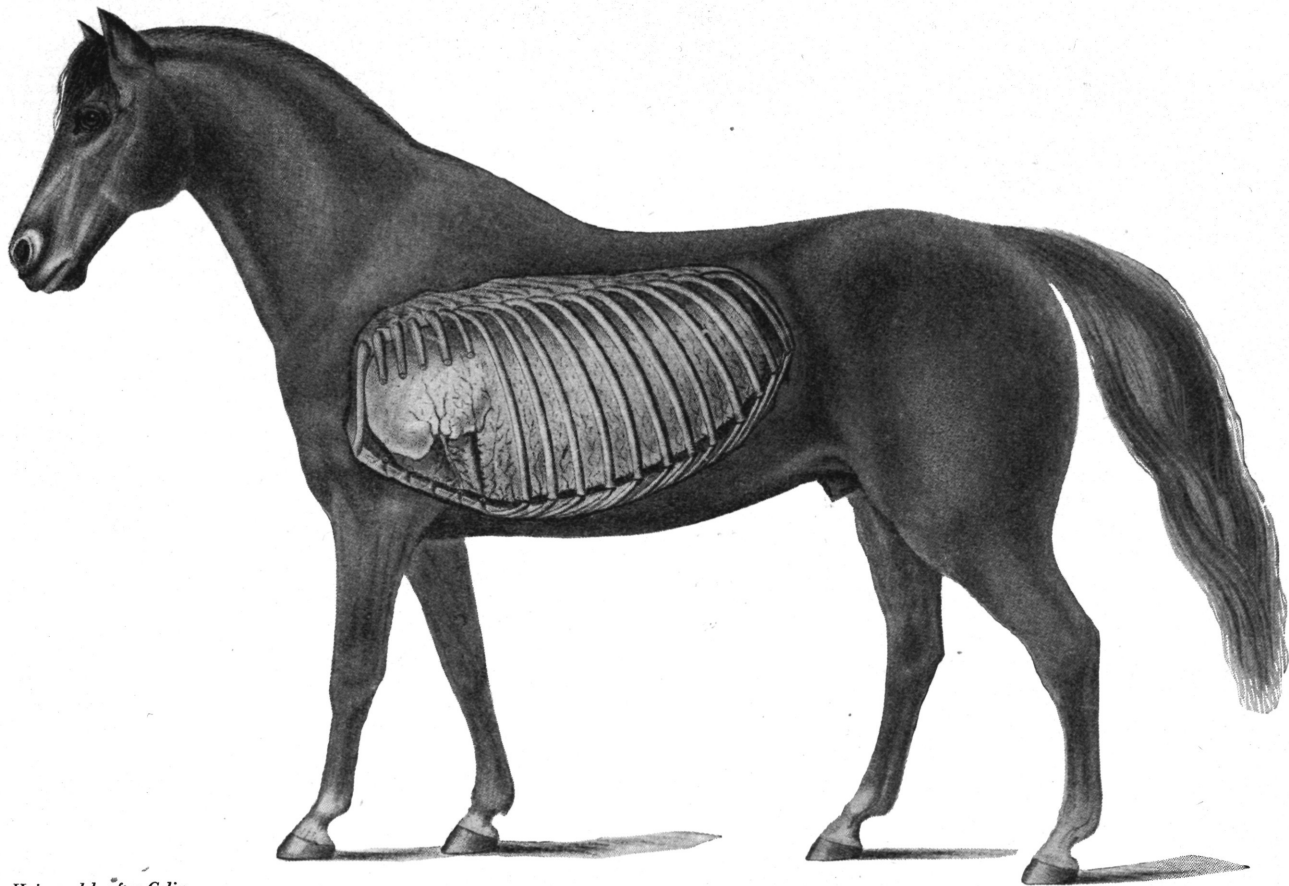
Grunting.—A common test used by veterinarians when examining the wind of a horse is to see whether the animal is a "grunter." This is a sound emitted during expiration when the animal is suddenly moved, startled, or struck at. If it grunts it is further tested for roaring. Grunters are not always roarers, but, as it is common for a roarer to grunt, such an animal must be looked on with suspicion until it is thoroughly tried by pulling a load or galloped up a hill. The test should be a severe one. Horses suffering with pleurisy, pleurodynia, or rheumatism, and other affections accompanied with much pain, will grunt when moved, or when the pain is aggravated, but grunting under these circumstances does not justify the term "grunter" being applied to the horse, as the grunting ceases when the animal recovers from the disease that causes the pain.

High blowing.—This term is applied to a noisy breathing made by some horses. It is distinctly a nasal sound and must not be confounded with roaring. The sound is produced by the action of the nostrils. It is a habit and not an indication of unsoundness. Contrary to roaring, when the animal is put to severe exertion the sound ceases. An animal that emits this sound is called a high blower. Some horses have naturally very narrow nasal openings, and they may emit sounds louder than usual in their breathing when exercised.

Whistling.—Whistling is only one of the variations of the sound emitted by a horse called a roarer and therefore needs no further notice, except to remind the reader that a whistling sound may be produced during an attack of severe sore throat or inflammation of the larynx, which disappears with the disease that causes it.

CHRONIC BRONCHITIS

This may be due to the same causes as those of acute bronchitis or it may follow the latter disease. An attack of the chronic form is likely to be converted into acute bronchitis by a very slight cause. This chronic affection in most instances is associated with thickening of the walls of the tubes. Its course is slower, it is less severe, and is not accompanied with so much fever as the acute form. If the animal is exerted, breathing becomes quickened and signs of exhaustion soon appear. In many instances the animal keeps up strength and appearances moderately well, but in other cases it has no appetite, loses flesh gradually, and becomes emaciated and debilitated. It has a



Haines, del. after Colin.

POSITION OF THE LEFT LUNG.

persistent cough, which in some cases is husky, smothered, or muffled, whereas in others it is hard and clear. A whitish pus, which may be curdled, is discharged from the nose. If the ear is placed against the chest behind the shoulder blade, the rattle of the air passing through the mucus can be heard within.

Treatment.—Rest is necessary, as even under the most favorable circumstances it is difficult to cure such bronchial affections. The animal cannot stand exertion and should not be compelled to undergo it. It should have much the same general care and medicinal treatment prescribed for the acute form. An application of mustard applied to the breast is beneficial. The diet should be the most nourishing. Bulky feed should not be given. Linseed mashes, scalded oats, and, if in season, grass and green-blade fodder are the best diet.

THE LUNGS

The lungs (pl. VII) are the essential organs of respiration. They consist of two (right and left) spongy masses, commonly called the lights, situated entirely within the thoracic cavity. On account of the space taken up by the heart, the left lung is the smaller. Externally, they are completely covered by the pleura. The structure of the lung consists of a light, soft, but very strong and remarkably elastic tissue, which can be torn only with difficulty. Each lung is divided into a certain number of lobes, which are subdivided into numberless lobules (little lobes). A little bronchial tube terminates in every one of these lobules. The little tube then divides into minute branches which open into the air cells (pulmonary vesicles) of the lungs. The air cells are little sacs having a diameter varying from one-seventieth to one two-hundredth of an inch; they have but one opening, the communication with the branches of the little bronchial tubes. Small blood vessels ramify in the walls of the air cells. The air cells are the consummation of the intricate structures forming the respiratory apparatus. They are of prime importance, all the rest being complementary. It is here that the exchange of gases takes place. As before stated, the walls of the cells are very thin; so, also, are the walls of the blood vessels. Through these walls there escapes from the blood the carbonic acid gas that has been absorbed by the blood in its circulation through the different parts of the body; through these walls also the oxygen gas, which is the life-giving element of the atmosphere, is absorbed by the blood from the air in the air cells.

CONGESTION OF THE LUNGS

Congestion is essentially an excess of blood in the vessels of the parts affected. Congestion of the lungs in the horse, when it exists as an independent affection, is generally caused by overexertion when the

animal is not in a fit condition to undergo more than moderate exercise. Very often what is recognized as congestion of the lungs is but a symptom of exhaustion or dilatation of the heart.

The methods, practiced by trainers, of running and trotting horses will give an idea of what is termed "putting a horse in condition" to stand severe exertion. The animal at first gets walking exercises, then after some time it is made to go faster and farther each day; the amount of work is increased daily until the animal is said to be in condition. A horse so prepared, if it is otherwise healthy, runs no risk of being affected with congestion of the lungs. On the other hand, if the horse is kept in the stable for the purpose of laying on fat or for want of something to do, the muscular system becomes soft, and the horse is not in condition to stand the severe exertion of going fast or far, no matter how healthy it may be in other respects. If such a horse be given a hard ride or drive, the animal may start off in high spirits, but soon becomes exhausted, and if pushed will slacken the pace, show a desire to stop, and may stagger or even fall. Examination will show the nostrils dilated, the flanks heaving, the countenance haggard, and the appearance of suffocation. The heart and muscles were not accustomed to the sudden and severe strain put upon them; the heart became unable to perform its work; the blood accumulated in the vessels of the lungs, which eventually became engorged with the stagnated blood, constituting congestion of the lungs.

The animal, after having undergone severe exertion, may not show alarming symptoms until returned to the stable; it will then be noticed standing with the head down, legs spread out, the eyes wildly staring or dull and sunken. Breathing is very rapid and almost gasping; in most cases the body is covered with perspiration, which, however, may soon evaporate, leaving the surface of the body and the legs and ears cold; breathing is both abdominal and thoracic; the chest rises and falls and the flanks are powerfully brought into action. If the pulse can be felt at all it will be found beating very frequently, one hundred or so to a minute. The heart may be felt tumultuously thumping if the hand is placed against the chest behind the left elbow, or it may be scarcely perceptible. The animal may tremble all over. If the ear is placed against the side of the chest a loud murmur and perhaps a fine, crackling sound will be heard.

One can scarcely fail to recognize a case of congestion of the lungs brought on by overexertion, as the history of the case indicates the nature of the ailment. In all cases of suffocation the lungs are congested. It is also seen in connection with other diseases.

Treatment.—If the animal is attacked by the disease while on the road, stop it immediately. Do not attempt to return to the stable. If the animal is in the stable, make arrangements at once to insure

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an unlimited supply of pure air. If the weather is warm, the open air is the best place for the animal, but if too cold let it stand with its head to the door. A horse in this condition has all it can do to obtain sufficient pure air to sustain life; therefore, it should be permitted to stand still. If the animal is encumbered with harness or saddle, remove it at once and rub the body with cloths or wisps of hay or straw. This stimulates the circulation in the skin and thus aids in relieving the lungs of the extra quantity of blood that is stagnated there. If three or four assistants are available, let them rub the body and legs well until the skin feels natural; rub the legs until they are warm, if possible. When the circulation is reestablished, put bandages on the legs from the hoofs up as far as possible. Throw a blanket over the body and let the rubbing be done under the blanket. Diffusible stimulants should be used—ether and aromatic spirits of ammonia. A drench of 2 ounces each of spirits of nitrous ether and alcohol, diluted with a pint of water, every hour until relief is afforded, is among the best remedies.

When the alarming symptoms have subsided, active measures may be stopped, but care must be used in the general treatment of the animal for several days for congestion may be followed by pneumonia. The animal should have a comfortable stall, free from drafts or sudden changes of temperature, and should be blanketed and the legs kept bandaged. The air should be pure; there should always be a plentiful supply of fresh, cold water in the stall; and a diet composed principally of bran mashes, scalded oats, and grass, if in season, should be fed. When ready for use again the horse at first should receive only moderate exercise, which may be increased daily until the animal may safely be put to regular work.

PNEUMONIA (LUNG FEVER)

Pneumonia is an inflammation of the lungs. The chief forms of pneumonia are catarrhal—later discussed in connection with bronchitis, under the name of bronchopneumonia—and the fibrinous or croupous form. The latter form receives its names from the fact that the air spaces are choked with coagulated fibrin thrown out from the blood. This causes the diseased portions of the lungs to become as firm as liver, in which condition they are said to be hepatized. As air is excluded by the inflammatory product, the diseased lung will not float in water.

The inflammation usually begins in the lower part of the lung and extends upward. The first stage of the disease consists of congestion, or engorgement, of the blood vessels, followed by leakage of serum containing fibrin from the blood vessels into the air passages. The

fluids thus escaping into the air cells and in the minute branches of the little bronchial tubes become coagulated.

The pleura covering the affected parts may be more or less inflamed. A continuance of the foregoing phenomena is marked by a further escape of the constituents of the blood and a change in the membrane of the cells, which becomes swollen. The exudate that fills the air cells and minute bronchial branches undergoes disintegration and softening when healing commences.

The favorable termination of pneumonia is in resolution; that is, a restoration to health. This is gradually brought about by the exuded material contained in the air cells and lung tissues being broken down and softened and absorbed or discharged through the nostrils. The blood vessels return to their natural state, and the blood circulates in them as before. In the cases that do not recover so readily the lung may become gangrenous (or mortified), an abscess may form, or the disease may be merged into the chronic form.

Pneumonia may be directly induced by any of the influences named as general causes for diseases of the organs of respiration, but in many instances it is from neglect. A common cold or sore throat, if neglected or improperly treated, may be followed by pneumonia. An animal may be debilitated by a cold, and when in this weakened state may be compelled to undergo exertion beyond its strength; or it may be kept in a badly ventilated stable, where the foul gases are shut in and the pure air is shut out; or the stable may be so open that parts of the body are exposed to drafts of cold air. An animal is predisposed to pneumonia when debilitated by any constitutional disease, and especially during convalescence if exposed to any of the exciting causes. Foreign bodies, such as feed accidentally getting into the lungs by way of the windpipe, as well as the inhalation of irritating gases and smoke, often produce fatal attacks of inflammation of the lung and bronchial tubes. Pneumonia is frequently seen in connection with other diseases, such as influenza, purpura hemorrhagica, strangles, or glanders. Pneumonia and pleurisy are most common during cold, damp weather, and especially during the prevalence of the cold north or northeasterly winds. Wounds puncturing the thoracic cavity may cause pneumonia.

Symptoms.—The first symptom of pneumonia, when a primary disease is a chill, more or less prolonged, which in many cases is not noticed. Breathing becomes accelerated, and the animal hangs its head and has a very dull appearance. The mouth is hot and has a sticky feeling to the touch; the heat conveyed to the finger in the mouth indicates fever; if a clinical thermometer is placed in the rectum the temperature will be found to be 103° F. or higher. The pulse is frequent, beating from 50 or 60 to 80 or more times a minute. There

is usually a dry cough from the beginning, which, however, changes in character as the disease advances; for instance, it may become moist, or if pleurisy sets in, the cough will be peculiar to the latter affection; that is, cut short in the endeavor to suppress it. In some cases the discharge from the nostrils is tinged with blood, whereas in other cases it has the appearance of muco-pus. The appetite is lost to a greater or less extent, but the desire for water is increased, particularly during the onset of the fever. The membrane within the nostrils is red and at first dry but sooner or later becomes moist. The legs are cold. The bowels are more or less constipated, and what dung is passed is usually covered with a slimy mucus. The urine is passed in smaller quantities than usual and is of a darker color.

The animal prefers to have the head where the freshest air can be obtained. When affected with pneumonia, a horse does not lie down but persists in standing from the beginning of the attack. If pneumonia is complicated with pleurisy, however, the horse may appear restless and lie down for a few moments to gain relief from the pleuritic pains, but soon rises. The breathing is rapid and difficult, but when the pneumonia is complicated with pleurisy the ribs are kept as quiet as possible and the breathing is abdominal; that is, the abdominal muscles are now made to do as much of the work as they can perform. If pleurisy is not present there is little pain. To the ordinary observer the animal may not appear dangerously ill, as it does not show the seriousness of the ailment by violence, as in colic, but a careful observer will discover at a glance that the trouble is more serious than a cold. By percussion it will be shown that some portions of the chest are less resonant than in health, indicating exclusion of air. If the air is largely excluded the percussion is dull, like that elicited by percussion over the thigh.

By auscultation important information may be gained. When the ear is placed against the chest of a healthy horse, the respiratory murmur is heard more or less distinctly, according to the part of the chest that is beneath the ear. In the very first stage of pneumonia this murmur is louder and hoarser; also, there is a fine, crackling sound somewhat similar to that produced when salt is thrown into a fire. After the affected part becomes solid there is an absence of sound over that particular part. After absorption begins one may again hear sounds that are of a more or less moist character and resemble bubbling or gurgling, which gradually change until the natural sound is heard, indicating a return to health.

When a fatal termination is approaching all the symptoms become intensified. Breathing becomes still more rapid and difficult; the flanks heave; the animal stares wildly about as if seeking aid to drive off the feeling of suffocation; the body is bathed with sweat;

the horse staggers but quickly recovers his balance; the animal may now, for the first time during the attack, lie down; it does so, however, in the hope of relief, which it fails to find, and with difficulty struggles to its feet; it pants; the nostrils flap; the animal staggers and sways from side to side and backward and forward, but still tries to retain the standing position, even by propping itself against the stall. After an exhausting fight for breath the horse goes down; the limbs stretch out and become rigid. In fatal cases death usually occurs in from 10 to 20 days after the beginning of the attack. On the other hand, when the disease is terminating favorably the signs are obvious. The fever abates and the animal gradually improves in appetite; it takes more notice of its surroundings; its spirits improve; it has a general appearance of returning health and lies down and rests. In the majority of cases pneumonia, if properly treated, terminates in recovery.

Treatment.—All types of pneumonia are of a serious nature and all treatment given should be made, whenever possible, under the supervision of a competent veterinarian.

The comfort and surroundings of the patient must be attended to first. The quarters should be the best that can be provided. Pure air is essential. Avoid placing the animal in a stall where there may be exposure to drafts of cold air and sudden changes of temperature. It is much better for the animal if the air is cold and pure than if it is warm and foul. It is better to make the animal comfortable with warm blankets than to make the stable warm by shutting off the ventilation. From the beginning the animal should have an unlimited supply of fresh, cool drinking water. Blanket the body. Rub the legs until they are warm and then put bandages on them from the hoofs up to the knees and hocks. If warmth cannot be reestablished in the legs by hand rubbing alone, apply dry, ground mustard and rub in well. The bandages should be removed once or twice every day, the legs well rubbed, and the bandages replaced. Much harm is often done by clipping off hair and rubbing in powerful blistering compounds. They do positive injury, retard recovery, and should not be allowed. Much benefit may be derived from hot applications to the sides of the chest if the facilities are at hand to apply them. If the weather is not too cold, and if the animal is in a comfortable stable, the following method may be tried: Have a tub of hot water handy to the stable door; soak a woollen blanket in the water, then quickly wring as much water as possible out of it and warp it around the chest. See that it fits closely to the skin; do not allow it to sag so that air may get between it and the skin. Now wrap a dry blanket over the wet hot one and hold in place with three girths. The hot blanket should be renewed every half hour, and while it is off being

wetted and wrung the dry one should remain over the wet part of the chest to prevent reaction. The hot applications should be kept up for 3 or 4 hours, and when stopped the skin should be quickly rubbed as dry as possible, an application of alcohol rubbed over the wet part, and a dry blanket snugly fitted over the animal. If the hot applications appear to benefit, they may be tried on 3 or 4 consecutive days. Unless every facility and circumstance favors the application of heat in the foregoing manner, it should not be attempted. If the weather is very cold or any of the details are omitted, more harm than good may result. Mustard may be applied by making a paste with a pound of freshly ground mustard mixed with warm water. This is to be spread evenly over the sides, back of the shoulder blades, and down to the median line below the chest. Care should be taken to avoid rubbing the mustard on the thin skin immediately back of the elbow. The mustard-covered area should be covered with a paper and this with a blanket passed up from below and fastened over the back. The blanket and paper should be removed in from 1 to 2 hours. When pneumonia follows another disease, the system is always more or less debilitated and requires the careful use of stimulants from the beginning. To weaken the animal still further by bleeding will retard recovery greatly and may even result in death.

Another and oftentimes fatal mistake made by the nonprofessional person is the indiscriminate and reckless use of aconite. This drug is one of the most active poisons and should not be handled by anyone who does not thoroughly understand its action and uses. It is only less active than prussic acid in its poisonous effects. It is a common opinion, often expressed by nonprofessionals, that aconite is a stimulant. Nothing could be more erroneous; in fact, it is just the reverse. It is one of the most powerful sedatives used in the practice of medicine. In fatal doses it kills by paralyzing the very muscles used in breathing; it weakens the action of the heart and should not be used. Do not give purgative medicines. If constipation exists, overcome it by an allowance of laxative diet, such as scalded oats, bran, and linseed mashes; also, grass, if in season. If the costiveness is not relieved by the laxative diet, give an enema of about a quart of warm water three or four times a day.

A diet consisting principally of bran mashes, scalded oats, and, when in season, grass or corn fodder is preferable if the animal retains an appetite; but if no desire is shown for feed of this kind, then the animal should be allowed to eat anything that will be taken willingly. Hay tea, made by pouring boiling water over good hay in a large bucket and allowing it to stand until cool, then straining off the liquid, will sometimes create a desire for feed. The animal may be

allowed to drink as much as it desires of this tea. Corn on the cob is often eaten when everything else is refused. Bread may be tried, also apples or carrots. If the animal will drink milk, it may be supported by it for days. Three or four gallons of sweet milk may be given during the day, in which may be stirred three or four fresh eggs to each gallon. Some horses will drink milk, whereas others will refuse it. It should be borne in mind that all feed must be taken by the horse willingly; none should be forced down him. If the animal will not eat, one must wait until a desire is shown for feed. All kinds may be offered, first one and then another, but feed should not be allowed to remain long in a trough or manger; the very fact of its constantly being before him will cause him to loathe it. When the animal has no appetite for anything, the stomach is not in a proper state to digest food, and if it is poured or drenched into the animal it will only cause indigestion and aggravate the case. It is a good practice to do nothing when there is nothing to be done that will benefit. This refers to medicine as well as feed.

There are many valuable medicines for the different stages and types of pneumonia, but as this work is intended for the use of those who are not sufficiently acquainted with the disease to recognize its various types and stages, a discussion of them would only confuse the reader. Consequently they are omitted. If a dram of sulfate of quinine in a capsule, or made into a ball, with sufficient linseed meal and molasses, is given every 3 hours during the height of the fever, it will do good in many cases. The ball of ammonium carbonate, as advised in the treatment of bronchitis, may be tried if the animal is hard to drench. The heart should be kept strong by administering digitalis in doses of 2 drams of the tincture every 3 hours.

If the horse becomes very much debilitated, stimulants of a more pronounced character are required. The following drench is useful: Rectified spirits, 3 ounces; spirits of nitrous ether, 2 ounces; water, 1 pint. This may be repeated every 4 or 5 hours if it seems to benefit.

During the period of convalescence good nutritive feed should be allowed in a moderate quantity. Tonic medicines should be substituted for those used during the fever. The same medicines advised for the convalescing period of bronchitis are equally efficient in this case, especially the potassium iodide; likewise, the same general instructions apply here.

The chief causes of death in pneumonia are heart failure from exhaustion, suffocation, or blood poisoning from death (gangrene) of lung tissue. The greater the area of lung tissue diseased the greater the danger; hence double pneumonia is more fatal than pneumonia of one lung.

THE WINDPIPE

The windpipe, or trachea as it is technically called, is the flexible tube that extends from the larynx, which it succeeds at the throat, to above the base of the heart in the chest, where it terminates by dividing into the right and left bronchi—the tubes going to the right and left lung, respectively. The windpipe is composed of about 50 incomplete rings of cartilage united by ligaments. A muscular layer is situated on the superior surface of the rings. Internally the tube is lined with a continuation of the mucous membrane that lines the entire respiratory tract, which here has very little sensibility in contrast to that lining the larynx, which is especially sensitive.

The windpipe is not subject to any special disease but is more or less affected during laryngitis (sore throat), influenza, bronchitis, and similar diseases, and requires no special treatment. The membrane may be left in a thickened condition after these attacks. One or more of the rings may be accidentally fractured, or the tube may be distorted or malformed as the result of violent injury. After the operation of tracheotomy it is not uncommon to find a tumor or malformation as a result of the operation. These defects require no particular attention in the way of treatment. However, any one of the before-mentioned conditions may constitute one of the causes of noisy respiration described as thick wind.

GUTTURAL POUCHES

These two sacs are situated above the throat and communicate with the pharynx as well as with the cavity of the tympanum of the ear. They are peculiar to solipeds. Normally, they contain air. Their function is unknown.

One or both guttural pouches may contain pus as a result of bacterial infection. The symptoms are as follows: Swelling on the side below the ear and an intermittent discharge of pus from one or both nostrils especially when the head is lowered.

The swelling is soft, and, if pressed upon, pus will escape from the nose if the head is lowered. As before mentioned, these pouches communicate with the pharynx, and through this small opening pus may escape. A recovery is probable if the animal is turned out to graze, or if it is fed from the ground, as lowering of the head favors the escape of pus from the pouches. It may be necessary to perform an operation, which should not be attempted by anyone unacquainted with the anatomy of the part.

BRONCHITIS AND BRONCHOPNEUMONIA

Bronchitis is an inflammation of the bronchial tubes. When this inflammation extends to the air sacs at the termini of the smallest

branches of the bronchial tubes, the disease is bronchopneumonia. Bronchitis affecting the larger tubes is less serious than that affecting the smaller ones. The disease may be either acute or chronic. The causes are generally much the same as for other diseases of the respiratory organs referred to in the beginning of this article. The special causes are these: Inhalation of irritating gases and smoke and fluids or solids gaining access to the parts. Bronchitis is occasionally associated with influenza and other specific fevers. It also supervenes on common cold or sore throat.

Symptoms.—The animal appears dull; the appetite is partially or wholly lost; the head hangs; the breathing is quickened; the cough, at first dry, and having somewhat the character of a barking cough, is succeeded in a few days by a moist, rattling cough; the mouth is hot; the visible membranes in the nose are red; the pulse is frequent, and during the first stage is hard and quick, but as the disease advances becomes smaller and more frequent. There is a discharge from the nostrils that is at first whitish but later becomes creamy or frothy, still later it is sometimes tinged with blood, and occasionally it may be of a brownish or rusty color. By auscultation, or placing the ear to the sides of the chest, unnatural sounds can now be heard. The air passing through the diseased tubes causes a wheezing sound when the small tubes are affected, and a hoarse, cooing, or snoring sound when the larger tubes are involved. After 1 or 2 days the dry stage of the disease is succeeded by a moist state of the membrane. The ear now detects a different sound, caused by the bursting of the bubbles as the air passes through the fluid, which is the exudate of inflammation and the augmented mucous secretions of the membrane. The mucus may be secreted in great abundance, which, by blocking up the tubes, may cause a collapse of a large extent of breathing surface. Usually the mucus is discharged through the nose. The discharge is coughed up, and when it reaches the larynx much of it may be swallowed, and some is discharged from the nostrils. The horse, unlike the human being, cannot spit, nor does the matter coughed up gain access to the mouth. If in serious cases all the symptoms become aggravated and the breathing is labored, short, and quick, the indication usually is that the inflammation has reached the breathing cells and that catarrhal pneumonia is established. In this case the ribs rise and fall much more than natural. This fact alone is enough to exclude the idea that the animal may be affected with pleurisy, because in that disease the ribs are kept in a fixed state as much as possible, and the breathing is accomplished to a great extent by aid of the abdominal muscles. The horse persists in standing throughout the attack. It prefers to stand with the head to a door or window to gain all the fresh air

possible, but if not tied may occasionally wander listlessly about the stall. The bowels most likely are constipated; the dung is covered with slimy mucus. The urine is decreased in quantity and darker in color than usual. The animal shows more or less thirst; in some cases the mouth is full of saliva. The discharge from the nose increases in quantity as the disease advances and inflammation subsides. This is rather a good symptom, as it shows that one stage has passed. The discharge then gradually decreases, the cough becomes less rasping, but of more frequent occurrence, until it gradually disappears with the return of health.

Bronchitis affecting the smaller tubes is one of the most fatal diseases, whereas that of the larger tubes is never very serious. However, it is an exceedingly difficult matter for a nonexpert to discriminate between the two forms, and also to discriminate between bronchitis and pneumonia.

Treatment.—The matter of first importance is to insure pure air to breathe, and next to make the patient's quarters as comfortable as possible. A well-ventilated box stall serves best for all purposes. Cover the body with a blanket, light or heavy, as the season of the year demands. Hand-rub the legs until they are warm, then wrap them in cotton and apply flannel bandages from the hoofs to the knees and hocks. If the legs cannot be warmed with hand rubbing alone, apply dry mustard. Rub in thoroughly and then put the bandages on; also rub mustard paste well over the side of the chest, covering the space beginning immediately behind the shoulder blade and running back about 18 inches, and from the median line beneath the breast to within 10 inches of the ridge of the backbone. Repeat the application to the side of the chest about 3 days after the first one is applied.

Compel the animal to inhale steam from a bucketful of boiling water containing a tablespoonful of oil of turpentine and spirits of camphor, as advised for cold in the head. In serious cases the steam should be inhaled every hour, and in any case the oftener it is done the greater will be the beneficial results. Three times a day administer an electuary containing potassium acetate (2 drams), with licorice and molasses or honey. It is well to keep a bucketful of cold water before the animal all the time. If the horse is prostrated and has no appetite, give the following drench: Spirits of nitrous ether, 2 ounces; rectified spirits, 3 ounces; water, 1 pint. Repeat the dose every 4 or 5 hours if it appears to benefit. When the horse is hard to drench, give the following: Pulverized ammonium carbonate, 3 drams; linseed meal and molasses sufficient to make the whole into a stiff mass; wrap it with a small piece of tissue paper and give as a ball. This ball may be repeated every 4 or 5 hours. When giving the ball,

care should be taken to prevent its breaking in the mouth, as in case of such accident it will make the mouth sore and prevent the animal from eating. If the bowels are constipated, give enemas of warm water. Do not give purgative medicines. Do not bleed the animal.

If the animal retains an appetite, a soft diet is preferable, such as scalded oats, bran mash, and grass, if in season. If the animal refuses cooked feed, allow in small quantities anything it will eat. Hay, ear corn, oats, bread, apples, and carrots may be tried in turn. Some horses will drink sweet milk when they refuse all other kinds of feed, and especially is this the case if the drinking water is withheld for a while. One or two gallons at a time, four or five times a day, will support life. When the disease is established recovery cannot occur in less than 2 or 3 weeks, and more time may be necessary. Good nursing and patience are required.

When the symptoms have abated and there remains only the cough and a white discharge from the nostrils, all other medicines should be discontinued and a course of tonic treatment pursued. Give the following mixture: Reduced iron, 3 ounces; powdered gentian, 8 ounces; mix well and divide into 16 powders. Give a powder every night and morning mixed with bran and oats, if the animal will eat it, or mixed with about a pint of flaxseed tea and administered as a drench.

If the cough remains after the horse is apparently well, give 1 dram of potassium iodide dissolved in a bucketful of drinking water 1 hour before each meal for 2 or 3 weeks if necessary. Do not put the animal to work too soon after recovery. Allow ample time to regain strength. This disease is prone to become chronic and may run into an incurable case of thick wind.

PLEURISY

The thoracic cavity is divided into two lateral compartments, each containing one lung and a part of the heart. Each lung has its separate pleural membrane, or covering. The pleura is the thin, glistening membrane that covers the lung and also completely covers the internal walls of the chest. It is very thin and to the ordinary observer appears to be part of the lung, which, in fact, it is for all practical purposes. The smooth, shiny surface of the lung, as well as the smooth, shiny surface so familiar on the rib, is the pleura. In health this surface is always moist. A fluid is thrown off by the pleura, which causes the surface to be constantly moist. This is to prevent the effects of friction between the lungs and the walls of the chest and other parts which come in contact. It must be remembered that the lungs dilate each time a breath is taken in, and contract each time a breath of air is expelled. It may be readily seen that if it were not for the moistened state of the surface of the pleura the

continual dilatation and contraction and the consequent rubbing of the parts against each other would cause serious friction.

Inflammation of this membrane is called pleurisy. Being so closely united with the lung, the pleura cannot always escape participation in the disease when the latter is inflamed. Pleurisy may be due to the same predisposing and exciting causes as mentioned in the beginning of this work as general causes for diseases of the organs of respiration, such as exposure to sudden changes of temperature and confinement in damp stables. It may be caused also by wounds that penetrate the chest, for such wounds necessarily pierce the pleura. A fractured rib may involve the pleura. The inflammation following such wounds may be circumscribed, that is, confined to a small area surrounding the wounds, or it may spread from the wound and involve a large portion of the pleura. The pleura may be involved secondarily when the heart or its membrane is the primary seat of the disease. It may occur in conjunction with bronchitis, influenza, and other diseases. Diseased growths that interfere with the pleura may induce pleurisy. The most frequent cause of pleurisy is an extension of inflammation from adjacent diseased lung. It is a common complication of pneumonia. Pleurisy is described here as an independent affection, although it is very often associated with the foregoing diseases.

The first lesion of pleurisy is overfilling of the blood vessels that ramify in this membrane and dryness of the surface. This is followed by the formation of a coating of coagulated fibrin on the diseased pleura and the transudation of serum which collects in the chest. This serum may contain flakes of fibrin and it may be straw-colored or red from an admixture of blood. The quantity of this accumulation may amount to several gallons.

Symptoms.—When the disease exists as an independent affection the first symptom is a chill, but this is usually overlooked. About the first thing noticed is the disinclination of the animal to move or turn around. When made to do so he grunts or groans with pain. He stands stiff; the ribs are fixed—that is, they move very little in the act of breathing—but the abdomen works more than is natural; both the forefeet and elbows may be turned out; during the onset of the attack the animal may be restless and act as if it had a slight colic; it may even lie down but does not remain down long, for when it finds no relief it soon gets up. After effusion begins these signs of restlessness disappear. Every movement of the chest causes pain; therefore the cough is short and suppressed. The breathing is hurried, the mouth is hot, the temperature being elevated from 102° or 103° to 105° F. Symptoms that usually accompany fever are present, such as constipation, scanty, dark-colored urine, etc. The pulse is

frequent, perhaps 70 or more a minute, and is hard and wiry. The legs and ears are cold.

Percussion is of valuable service in this affection. After effusion occurs the sound produced by percussing over the lower part of the chest is dull. By striking different parts one may come to a spot of greater or less extent where the blows cause much pain. The animal may grunt or groan every time it is struck. Another method of detecting the affected part is to press the fingers between the ribs, each space in succession, beginning behind the elbow, until a place where the pressure causes more flinching than at any other part is reached. Auscultation is also useful. In the first stage, when the surfaces are dry and rough, one may hear, immediately under the ear, a distinct sound very much like that produced by rubbing two pieces of coarse paper together. No such friction sound occurs when the membrane is healthy, as the natural moisture, heretofore mentioned, prevents the friction. In many cases this friction is so pronounced that it may be felt by placing the hand over the affected part. When the dry stage is succeeded by exudation of fluids this friction sound disappears. After the effusion into the cavity takes place sometimes there is heard a tinkling or metallic sound, due to dropping of the exudate from above into the collected fluid in the bottom of the cavity, as the collected fluid more or less separates the lung from the chest walls.

Within 2 or 3 days the urgent symptoms may abate owing to the exudation of the fluid and the subsidence of the pain. The fluid may now undergo absorption, and the case may terminate favorably within a week or 10 days.

If the quantity of the effusion is large its own volume retards the process of absorption to a great extent, and consequently convalescence is delayed. In severe cases the pulse becomes more frequent, the breathing more hurried and labored, the flanks work like bellows, the nostrils flap, the eyes stare wildly, the countenance expresses much anxiety, and general signs of dissolution are plain. After a time swellings appear under the chest and abdomen and down the legs. The accumulation in the chest is called hydrothorax, or dropsy of the chest. When this fluid contains pus the case usually proves fatal. The condition of pus within the cavity is called empyema.

Pleurisy may affect only a small area of one side or it may affect both sides. It is oftener confined to the right side.

Treatment.—The instructions in regard to the general management of bronchitis and pneumonia must be adhered to in the treatment of pleurisy. Comfortable quarters, pure air, warm blanketing of the body and bandages to the legs, a plentiful supply of pure cold water, and laxative feed in this case are equally necessary and efficacious. Hot applications applied to the chest, as directed in the treatment

of pneumonia, are very beneficial in pleurisy and should be kept up while the symptoms show the animal to be in pain.

During the first few days, when pain is manifested by restlessness, apply hot packs to the sides diligently. After 4 or 5 days, when the symptoms show that the acute stage has somewhat subsided, mustard may be applied as recommended for pneumonia. From the beginning the following drench may be given every 6 hours: Solution of ammonium acetate, 3 ounces; spirits of nitrous ether, 1 ounce; potassium bicarbonate, 3 drams; water, 1 pint.

If the patient becomes debilitated, the stimulants as prescribed for pneumonia should be used according to the same directions. The same attention should be given to the diet. If the animal will eat bran mashes, scalded oats, and grass, these should be given, but if it refuses the laxative diet, then different kinds of feed should be tried and the one that the animal desires should be given.

In the beginning of the attack, if the pain is so severe as to cause the animal to lie down or paw, fluid extract of cannabis indica may be used in doses of 2 to 4 drams.

If the case is not progressing favorably in 10 to 12 days after the beginning of the attack, convalescence is delayed by the fluid in the chest failing to be absorbed. The animal becomes dull and weak and shows little or no desire for feed. Breathing becomes still more rapid and difficult. An effort must now be made to excite the absorption of the effusion. An application of liniment or mild blistering agent should be rubbed over the lower part of both sides and the bottom of the chest. The following drench may be given three times a day for 7 or 8 days if it is necessary and appears to benefit: Tincture of ferric chloride, 1 ounce; tincture of gentian, 2 ounces; water, 1 pint. Also give 1 dram of potassium iodide, dissolved in the drinking water, an hour before feeding every night and morning for a week or two.

Hydrothorax, or fluid in the chest cavity, is sometimes difficult to overcome by medicines alone; in such cases the chest should be tapped to allow an escape for the accumulated fluid. This operation is performed with a combined instrument called the trocar and cannula. The puncture is made in the lower part of the chest, in the space between the eighth and ninth ribs. Wounding of the intercostal artery is avoided by inserting the instrument as near as possible to the anterior edge of the rib. The operation is of benefit only when performed before the strength is lowered beyond recovery. The operation merely receives a passing notice here since it should be performed by a competent veterinarian, in which case it is attended with little danger or difficulty.

Bronchitis, pneumonia, and pleurisy have been described mainly as they occur as independent diseases, but they merge into each other

and may occur together at one time. Because of the different stages and types of the affections and also because of the different treatment for each stage and each particular type, a veterinarian should always be consulted for these diseases, when available. Consequently only simple recommendations regarding the treatment of each of these diseases are given in this publication.

PLEUROPNEUMONIA

This is the term applied when an animal is affected with pleurisy and pneumonia combined, which is frequently the case. At the beginning of the attack only one of the affections may be present, but the other soon follows. It has already been stated that the pleura is closely adherent to the lung. The pleura on this account is frequently more or less affected by the spreading of the inflammation from the lung tissue. There is a combination of the symptoms of both diseases, but to the ordinary observer the symptoms of pleurisy are the more obvious. The course of treatment is the same as that used when the two diseases occur independently.

BRONCHOPLEUROPNEUMONIA

This is the term applied when bronchitis, pleurisy, and pneumonia all exist at once. It is impossible for one who is not an expert to diagnose the state with certainty. The apparent symptoms are the same as when the animal is affected with pleuropneumonia.

SUPPURATION AND ABSCESS IN THE LUNG

There are instances, especially when the surroundings of the patient have been bad or the disease is of an especially severe type, when pneumonia terminates in an abscess in the lung. Sometimes, when the inflammation has been extreme, suppuration in a large portion of the lung takes place. Impure air, the result of improper ventilation, is among the most frequent causes of this termination. The symptoms of suppuration in the lung are chronic pneumonia, a solidified area of lung tissue, continued low fever, and, in some cases, offensive breath, and the discharge of pus from the nostrils.

MORTIFICATION

Gangrene, or mortification, means the death of the part affected. Occasionally, owing to the intensity of the inflammation or bad treatment, pneumonia and pleuropneumonia terminate in mortification, which is soon followed by the death of the animal. Perhaps the most common cause of this complication is the presence of a foreign body in the lung, as food particles or medicine. Rough drenching or drenching through the nostrils may cause this serious condition.

HEMOPTYSIS (BLEEDING FROM THE LUNGS)

Bleeding from the lungs may occur during the course of congestion of the lungs, bronchitis, pneumonia, influenza, purpura hemorrhagica, or glanders. An accident or exertion may cause a rupture of a vessel. Plethora and hypertrophy of the heart predispose to it. Following the rupture of a vessel the blood may escape into the lung tissue and cause a serious attack of pneumonia, or it may fill up the bronchial tubes and prove fatal by suffocating the animal. When the hemorrhage is from the lung it is accompanied with coughing; the blood is frothy, of a bright red color, and comes from both nostrils; whereas when the bleeding is merely from a rupture of a vessel in some part of the head (heretofore described as bleeding from the nose) the blood is most likely to issue from one nostril only, and the discharge is not accompanied with coughing. The ear may be placed against the windpipe along its course, and if the blood is from the lungs a gurgling or rattling sound will be heard. When it occurs in connection with another disease it seldom requires special treatment. When caused by accident or overexertion the animal should be kept quiet. If the hemorrhage is profuse and continues for several hours 1 ounce of the tincture of ferric chloride diluted with a pint of water may be given. It is rare that the hemorrhage is so profuse as to require internal remedies. But in rare instances hemorrhage into the lung may occur and cause death by suffocation without the least manifestation of it by the discharge of blood from the nose.

TUBERCULOSIS OF THE LUNGS

Pulmonary consumption or tuberculosis has been recognized in the horse in a number of instances. The symptoms are as of chronic pneumonia or pleurisy. There is no treatment for the disease.

HEAVES (BROKEN WIND, ASTHMA)

Much confusion exists in the popular mind in regard to the nature of heaves. Many horsemen loosely apply the term to all ailments in which the breathing is difficult or noisy. Veterinarians are well acquainted with the phenomena and locality of the affection, but there is a great diversity of opinion in regard to the exact cause. Asthma is generally thought to be caused by spasm of the small circular muscles that surround the bronchial tubes. The continued existence of this affection of the muscles leads to a paralysis of them, and the forced breathing to emphysema, which always accompanies heaves.

Heaves is usually associated with disorder of the function of digestion or to an error in the choice of feed. Feeding clover hay or

damaged hay or straw, too bulky and innutritious feed, and keeping the horse in a dusty atmosphere or a badly ventilated stable seem to predispose to heaves. Horses brought from a high to a low altitude are predisposed.

In itself broken wind is not a fatal disease, but death is generally caused by an affection closely connected with it. After death, if the organs are examined, the lesions found depend much on the length of time broken wind has affected the animal. In recent cases very few changes are noticeable, but in animals that have been broken-winded for a long time the changes are well marked. The lungs are paler than natural and of much less weight in proportion to the volume, as evidenced by floating them in water. The walls of the small bronchial tubes and the membrane of the larger tubes are thickened. The right side of the heart is enlarged and its cavities dilated. The stomach is enlarged and its walls stretched. The important change found in the lungs is a condition technically called pulmonary emphysema. This is of two varieties: First, what is termed "vesicular emphysema," which consists of an enlargement of the air cells (air vesicles) by dilation of their walls, and second, what is called interlobular, or interstitial, emphysema, which follows the first. In this variety the air infiltrates the lung tissue between the air cells or the tissue between the small lobules.

Symptoms.—Almost every experienced horseman is able to detect heaves. The peculiar movement of the flanks and abdomen point out the ailment at once. In recent cases, however, the affected animal does not always exhibit the characteristic breathing unless exerted to a certain extent. The cough that accompanies this disease is peculiar to it. It is difficult to describe, but the sound is short and something like a grunt. When air is taken in, it appears to be done in the same manner as in health; it may possibly be done a little quicker than natural, but not enough to attract any notice. It is when the air is expelled from the lungs that the great change in the breathing is perceptible. It must be remembered that the lungs have lost much of their elasticity and, in consequence, of their power for contracting on account of the degeneration of the walls of the air cells, and also on account of the paralysis of muscular tissue before mentioned. The air passes into them freely, but the power to expel it is lost to a great extent by the lungs; therefore the abdominal muscles are brought into play. These muscles, especially in the region of the flank, are seen to contract, then pause for a moment, then complete the act of contracting, thus making a double bellowslike movement at each expiration, a sort of jerky motion with every breath. The double expiratory movement may also be detected by allowing the horse to exhale against the face or back of the hand. It will be ob-

served that the expiratory current is not continuous but is broken into two jets. When the animal is exerted a wheezing noise accompanies the breathing. This noise may be heard to a less extent when the animal is at rest if the ear is applied to the chest.

As mentioned before, indigestion is often present in these cases. The animal may have a depraved appetite, as shown by a desire to eat dirt and soiled bedding, which it often devours in preference to the clean feed in the trough or manger. The stomach is likely to be overloaded with indigestible feed. The abdomen may assume a potbellied form. The animal frequently passes wind of a very offensive odor. When first put to work the animal passes dung frequently; the bowels are often loose. The animal cannot stand much work, as the muscular system is soft. Round-chested horses are said to be predisposed to the disease, and it is certain that in cases of long standing the chest usually becomes rounder than natural.

Certain persons become very expert in suppressing, for a short time, the symptoms of a horse affected with heaves. They take advantage of the fact that the breathing is much easier when the stomach and intestines are empty. They also resort to the use of medicines that have a depressing effect. When the veterinarian is examining a horse for soundness and he suspects that the animal has been "fixed," he usually gives the horse as much water as it will drink and then has it ridden or driven rapidly up a hill or on a heavy road. This will bring out the characteristic breathing of heaves if the horse is so afflicted but will not cause the symptoms of heaves in a healthy horse. All broken-winded horses have the cough peculiar to the affection, but it is not regular. A considerable time may elapse before it is heard and then it may come on in paroxysms, especially when first brought out of the stable into the cold air, when excited by work, or after a drink of cold water. The cough is usually the first symptom of the disease.

Treatment.—When the disease is established there is no cure for it. Proper attention to the diet will relieve the distressing symptoms to a certain extent, but they will undoubtedly reappear in their intensity the first time the animal overloads the stomach or is allowed feed of bad quality. Clover hay or bulky feed which contains but little nutriment have much to do with the cause of the disease and therefore should be entirely omitted when the animal is affected, as well as before. The diet should be confined to feed of the best quality and in the smallest quantity. The bad effect of moldy or dusty hay, fodder, or feed of any kind cannot be overestimated. A small quantity of the best hay once a day is sufficient. This should be cut and dampened. The animal should invariably be watered before feeding, never directly after a meal, and it should not be worked immediately after a meal. Exertion, when the stomach is full, invariably aggravates the symp-

toms. Turning on pasture gives relief. Carrots, potatoes, or turnips chopped and mixed with oats or corn are a good diet. Half a pint to a pint of thick, dark molasses with each feeding is useful because of its appetizing and laxative effects. If the bowels do not act regularly, a pint of raw linseed oil may be given once or twice a month, or a handful of Glauber's salt may be given in the feed twice daily, as long as necessary. It must be borne in mind, however, that all medicinal treatment is of secondary consideration; careful attention paid to the diet is of greatest importance. Broken-winded animals should not be used for breeding purposes. A predisposition to the disease may be inherited.

CHRONIC COUGH

A chronic cough may follow an acute disease of the respiratory organs, such as pneumonia, bronchitis, and laryngitis. It accompanies chronic roaring, chronic bronchitis, and heaves; it may succeed influenza. As previously stated, cough is but a symptom and not a disease in itself. Chronic cough is occasionally associated with diseases other than those of the organs of respiration. It may be a symptom of chronic indigestion or of worms. In such cases it is caused by a reflex nervous irritation. In all cases of chronic cough the proper procedure is to ascertain the nature of the disease of which it is a symptom, and then cure the disease if possible, and the cough will cease.

The treatment of the affections will be found under their appropriate heads, to which the reader is referred.

PLEURODYNIA

This is a form of rheumatism that affects the intercostal muscles; that is, the muscles between the ribs. The apparent symptoms are very similar to those of pleurisy. The animal is stiff and not inclined to turn round; the ribs are kept in a fixed state as much as possible. If the head is pulled round suddenly, or the affected side struck with the hand, or if the spaces between the ribs are pressed with the fingers, the animal will flinch and perhaps emit a grunt or groan expressive of much pain. It is distinguished from pleurisy by the absence of fever, cough, the friction sound, the effusion into the chest, and by the existence of rheumatism in other parts. The treatment for this affection is the same as for rheumatism affecting other parts.

WOUNDS PENETRATING THE WALLS OF THE CHEST

A wound penetrating the wall of the chest admits air into the thoracic cavity outside the lung. This condition is known as pneumothorax and may result in collapse of the lung. The wound may be

so made that when the walls of the chest are dilating a little air is sucked in, but during the contraction of the wall the contained air presses against the torn part in such a manner as entirely to close the wound; thus a small quantity of air gains access with each inspiration, whereas none is allowed to escape until the lung is pressed into a very small compass and forced into the anterior part of the chest. The same thing may occur from a broken rib inflicting a wound in the lung. In this form the air gains access from the lung, and there may not be even an opening in the walls of the chest. In such cases the air may be absorbed, when a spontaneous cure is the result, but when the symptoms are urgent it is recommended that the air be removed by a trocar and cannula or by an aspirator, manipulated by a veterinarian.

Treatment of wounds that penetrate the thoracic cavity should be prompt. It should be quickly ascertained whether or not a foreign body remains in the wound; then it should be thoroughly cleaned with a solution of 1 part of carbolic acid in 40 parts of water. The wound should then be closed immediately. If it is an incised wound, it should be closed with sutures or with adhesive plasters; if torn or lacerated, adhesive plaster may be used or a bandage around the chest over the dressing. At all events, air must be prevented from getting into the chest as soon and as effectually as possible. The aftertreatment of the wound should consist principally in keeping the parts clean with a solution of carbolic acid, and applying fresh dressing as often as required to keep the wound in a healthy condition. Care should be taken that the discharges from the wound have an outlet in the most pendent part. (See Wounds and their Treatment, p. 454.) If pleurisy supervenes, it should be treated as advised under that head.

THUMPS (SPASM OF THE DIAPHRAGM)

Thumps is generally thought by the inexperienced person to be a palpitation of the heart. Although it is true that palpitation of the heart is sometimes called thumps, it must not be confused with the affection under consideration.

In the beginning of this article on the diseases of the organs of respiration, the diaphragm was briefly referred to as the principal and essential muscle of respiration. Spasmodic or irregular contractions of it in man are manifested by what is familiarly known as hiccoughs. Thumps in the horse is similar to hiccoughs in man, although in all cases the peculiar noise is not made in the throat of the horse.

There should be no difficulty in distinguishing this affection from palpitation of the heart. The jerky motion affects the whole body and is not confined to the region of the heart. If one hand is placed

on the body at about the middle of the last rib, while the other hand is placed over the heart behind the left elbow, it will be easily demonstrated that there is no connection between the thumping or jerking of the diaphragm and the beating of the heart. In fact, when the animal is affected with spasms of the diaphragm the beating of the heart is usually much weaker and less perceptible than natural. Thumps is produced by causes similar to those that produce congestion of the lungs and dilatation or palpitation of the heart, and may occur in connection with these conditions. If not relieved, death usually results from congestion or edema of the lungs, as the breathing is interfered with so much by the inordinate action of this important muscle of inspiration that proper aeration of the blood cannot take place. The treatment should be as prescribed for congestion of the lungs, and, in addition, antispasmodics, such as 1 ounce of sulfuric ether in warm water or 3 drams of asafetida.

RUPTURE OF THE DIAPHRAGM

Post-mortem examinations after colic or severe accident sometimes reveal rupture of the diaphragm. This may take place after death, from the generation of gases in the decomposing carcass, which distend the intestines so that the diaphragm is ruptured by the great pressure against it. The symptoms are intensely difficult respiration and great depression. There is no treatment.

Diseases of the Urinary Organs

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[Revised by MAURICE S. SHAHAN, D. V. M.]

USES OF THE URINARY ORGANS

The urinary organs constitute the main channel through which are excreted nitrogenous or albuminoid material, whether derived directly from the feed or from the muscular and other nitrogenized tissues of the body. They constitute, besides, the channel through which are thrown out most of the poisons, whether taken in by the mouth or skin or developed in connection with faulty or natural digestion, blood forming, nutrition, or, tissue destruction; or, finally, poisons that are developed within the body as the result of normal cell life or of the life of bacterial or other germs that have entered the body from without. Bacteria themselves may leave the body through the kidneys. To a large extent, therefore, these organs are the sanitary scavengers and purifiers of the system, and when their functions are impaired or arrested the retained poisons quickly show their presence in resulting disorders of the skin and connective tissue beneath it, of the nervous system, or other organs. Nor is this influence one-sided. Scarcely an important organ of the body can suffer derangement without entailing a corresponding disorder of the urinary system. Nothing is more striking than the mutual balance maintained between the liquid secretions of the skin and kidneys during hot and cold weather. In summer, when so much liquid exhales through the skin as sweat, comparatively little urine is passed, whereas in winter, when the skin is inactive, the urine is correspondingly increased. This vicarious action of skin and kidneys is usually kept within the limits of health, but at times the draining off of the water by the skin leaves too little to keep the solids of the urine safely in solution, and these are likely to crystallize out and form calculi (stone or gravel). Similarly the passage, in the sweat, of some of the solids that normally leave the body, dissolved in the urine, may irritate the skin and produce troublesome eruptions.

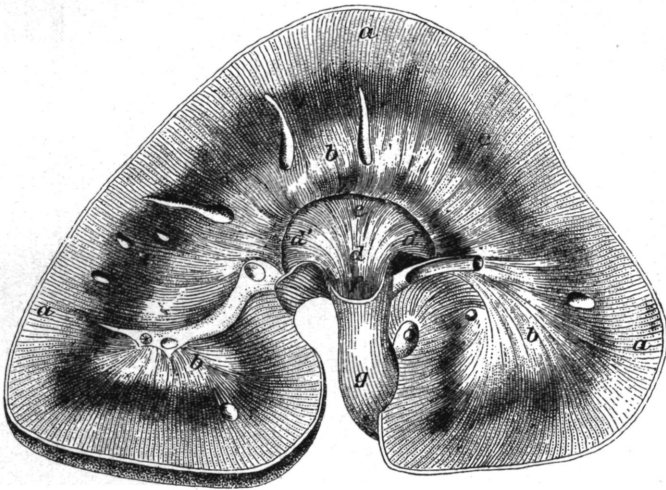
PROMINENT CAUSES OF URINARY DISORDERS

A disordered liver contributes to the production under different circumstances of an excess of biliary coloring matter that stains the

urine; of an excess of hippuric acid and allied products that, being less soluble than urea (the normal product of tissue change), favor the formation of stone, of taurocholic acid, and other bodies that tend when in excess to destroy the blood globules and to cause irritation. Any disorder leading to impaired functional activity of the lungs causes an excess of hippuric acid and allied bodies, of oxalic acid, etc., in the urine, which irritate the kidneys, even if they do not produce solid deposits in the urinary passages. Diseases of the nervous system and, notably, of the base of the brain and of the spinal cord induce various urinary disorders, prominent among which are diabetes, chylous urine, and albuminuria. Certain affections, with imperfect nutrition or destructive waste of the bony tissues, tend to charge the urine with phosphates of lime and magnesia and influence the formation of stone and gravel. In all extensive inflammations and acute fevers the liquids of the urine are diminished, whereas the solids (waste products), which should form a minor part of the urinary secretion, are increased, and the surcharged urine irritates the urinary organs or the retained waste products poison the system at large.

Diseases of the heart and lungs, by interfering with the free, onward flow of the blood from the right side of the heart, tend to throw that liquid back on the veins, and this backward pressure of venous blood strongly tends to disorders of the kidneys. Certain substances taken with the feed and water, notably that found in magnesian limestone and those in irritant, diuretic plants, are injurious to the kidneys, as are also various cryptogams, whether in musty hay or oats. The kidneys may be irritated by feeding green vegetables covered with hoarfrost or by furnishing an excess of feed rich in phosphates (wheat bran, beans, peas, vetches, lentils, rape cake, cottonseed cake) or by a privation of water, which entails a concentrated condition and high specific gravity of the urine. Azoturia and swamp fever are diseases in which the kidneys may be particularly involved. Exposure to cold rain or snowstorms, cold drafts of air, and damp beds are likely to disorder further an already overworked or irritable kidney. Finally, sprains of the back and loins may cause bleeding from the kidneys or inflammation.

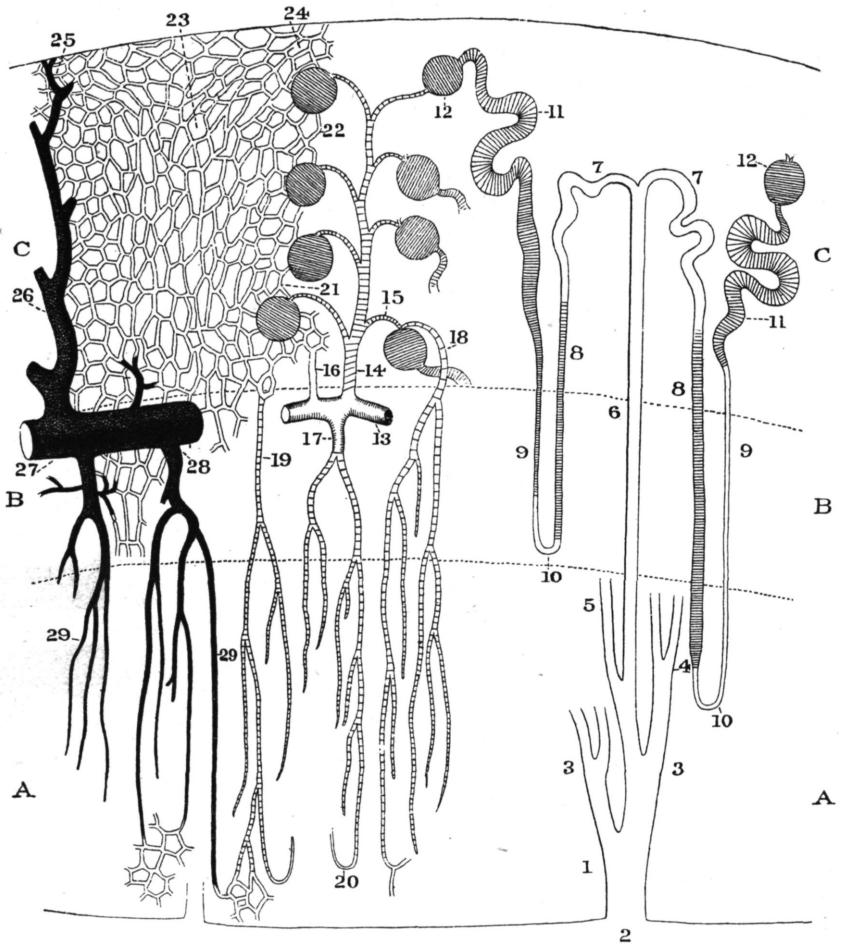
The right kidney, weighing about 23 to 24 ounces, is shaped like the heart on a playing card and extends from the loins forward to beneath the heads of the last two ribs. The left kidney (pl. VIII) resembles a bean in shape and extends from the loins forward beneath the head of the last rib only. Each consists of three distinct parts—(a) the external (cortical), or vascular part, in which the blood vessels form elaborate capillary networks within the dilated globular sacs that form the beginnings of the secreting (uriniferous) tubes and on the surface of the sinuous, secreting tubes leading from the sacs inward



Geo. Marx, after D'Arboval, p. 669.

a, Cortical (or vascular) portion; *b*, Medullary (or tubular) portion; *c*, Peripheral portion of the latter; *d*, Interior of the pelvis; *d'*, *d'*, Arms of the pelvis; *e*, Border of the crest; *f*, Infundibulum; *g*, Ureter.

LONGITUDINAL SECTION THROUGH KIDNEY.



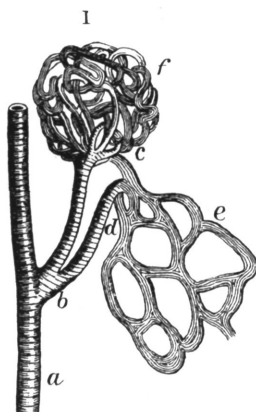
Geo. Marx, after D'Arboval, p. 372.

STRUCTURE OF THE KIDNEY. DIAGRAMMATIC.

A, Medullary layer; *B*, Boundary zone; *C*, Cortical layer. 1, Excretory tube; 2, Opening on the summit of renal papilla; 3, First branch of bifurcation; 4, Second branch of bifurcation; 5, Third branch of bifurcation; 6, Straight collecting tube; 7, Junctional tubule; 8, Ascending portion of Henle's loop; 9, Descending portion of Henle's loop; 10, Loop of Henle; 11, Convoluted tubule; 12, Malpighian corpuscle; 13, Renal artery; 14, Branch supplying the glomeruli; 15, Afferent vessel of the glomeruli; 16, Branch going directly to the capillaries; 17, Straight arterioles coming directly from the renal artery; 18, Straight arteriole coming from the afferent vessel of the glomerulus; 19, Straight arteriole coming from the capillary plexus; 20, Vascular loop of the pyramids; 21, Efferent vessel of the glomerulus going to the capillary plexus; 22, Capillary plexus of the glomerular part of the cortical substance; 23, Capillary plexus of the pyramids of Ferrein; 24, Cortical plexus of the kidney; 25, Venae stellatae; 26, Vein coming from the capillaries of the cortex; 27, Interlobular vein; 28, Vein receiving the venae rectae; 29, Venae rectae.

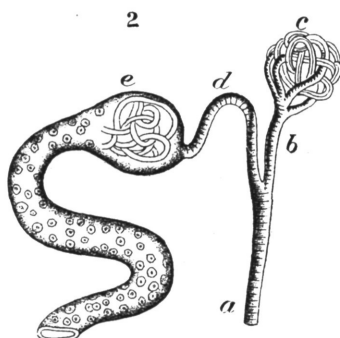
Note.—The shaded part of the urinary ducts represent the part in which the epithelium is rodged and of a granular appearance.

MICROSCOPIC ANATOMY OF KIDNEY.



RENAL GLOMERULUS.

a, Artery of the glomerulus; *b*, Branch supplying the afferent vessel of the glomerulus; *c*, Afferent vessel of the glomerule; *d*, Artery going directly to the capillary plexus of the cortical substance; *e*, Capillary plexus; *f*, Glomerulus.



Geo. Marx, after D'Arboval, p. 373.

RENAL GLOMERULUS WITH ITS AFFERENT VESSELS AND EFFERENTS.

a, Branch of renal artery; *b*, Afferent vessel of the glomerulus; *c*, Glomerulus; *d*, Afferent vessel going into corpuscle *e*, of Malpighi.

MICROSCOPIC ANATOMY OF KIDNEY.

toward the second, or medullary, part of the organ; (b) the internal (medullary) part, made up in the main of blood vessels, lymphatics, and nerves extending between the notch on the inner border of the kidney to and from the outer vascular portion, in which the secretion of urine is almost exclusively carried on; and (d) the pelvis, a large, saccular reservoir in the center of the kidney, into which all uriniferous tubes pour their secretions and from which the urine is carried away through a tube *g* (ureter), which passes out of the notch at the inner border of the kidney and which opens by a valve-closed orifice into the roof of the bladder just in front of its neck. The bladder is a dilatable reservoir for the retention of the urine until the discomfort of its presence causes its voluntary discharge. It is kept closed by circular, muscular fibers surrounding its neck or orifice and is emptied by looped, muscular fibers extending in all directions forward from the neck around the blind anterior end of the sac. From the bladder the urine escapes through a dilatable tube (urethra) that extends from the neck of the bladder backward on the floor of the pelvis, and in the male through the penis to its free end, where it opens through a pink, conical papilla. In the mare the urethra is not more than 2 to 3 inches in length and is surrounded by the circular, muscular fibers closing the neck of the bladder. Its opening may be found directly in the median line of the floor of the vulva, about $4\frac{1}{2}$ inches from its external opening.

GENERAL SYMPTOMS OF DISEASE

These apply especially to acute inflammations and the irritation caused by stone. The animal moves stiffly on its hind limbs, straddles, and makes frequent attempts to pass urine, which may be in excess, deficient in amount, liable to sudden arrest in spite of the straining, passed in dribblets, or entirely suppressed. Again, it may be modified in density or constituents. Difficulty in making a sharp turn, or in lying down and rising with or without groaning, dropping the back when mounted or when pinched on the loins is suggestive of kidney disease, and so to a less extent are swelled legs, dropsy, and diseases of the skin and nervous system. The oiled hand introduced through the rectum may feel the bladder beneath and detect any overdistention, swelling, tenderness, or stone. In ponies the kidneys even may be reached.

EXAMINATION OF THE URINE

In some cases the changes in the urine are the sole sign of disease. In health the horse's urine is of a deep amber color and has a strong odor. The consistence of the fluid depends to a considerable extent on the feed and to a lesser degree on the sex. Normal horse urine is

usually more or less cloudy, depending on the amount of carbonate of lime that it contains. During estrum the urine of some mares has a glairy, tenacious consistence.

Of the morbid changes of the urine, the following are to be looked for: (1) Color: White from deposited salts of lime; brown or red from blood clots or coloring matter; yellow or orange from bile or blood pigments; pale from excess of water; or variously colored from vegetable ingredients (santonin makes it red; rhubarb or senna, brown; tar or carbolic acid, green). (2) Density: The specific gravity of horse's urine may be 1.025 to 1.060, but it may greatly exceed this in diabetes and may sink to 1.007 in diuresis. (3) Chemical reaction, as ascertained by blue or red litmus test papers. The horse on a vegetable diet has alkaline urine turning red test papers blue, whereas in the suckling colt and the horse fed on flesh or on his own tissue (in starvation or abstinence during disease) it is acid, turning blue litmus red. (4) Organic constituents, as when glairy from albumin coagulable by strong nitric acid and boiling, when charged with microscopic casts of the uriniferous tubes, with the eggs or bodies of worms, with sugar, blood, pus, or bile. (5) In its salts, which may crystallize out spontaneously, or on boiling, or on the addition of chemical reagents.

Albuminous urine in the horse is frequently glairy, so that it may be drawn out in threads, but its presence can always be tested as follows: If the liquid is opaque, it may be first passed through filter paper; if very dense and already precipitating its salts, it may be diluted with distilled water; add to the suspected liquid acetic acid, drop by drop until it reddens the blue litmus paper; then boil gently in a test tube; if a precipitate is thrown down, set the tube aside to cool and then add strong nitric acid. If the precipitate is not dissolved, it is albumin; if dissolved it is probably urate or hippurate of ammonia. Albumin may be present after prolonged or violent exercise; abnormally it is seen in diseases in which there occurs destruction of blood globules (anthrax, infectious anemia), in diseases of the heart and liver that prevent the free escape of blood from the veins and throw back venous pressure on the kidneys, in inflammation of the lungs and pleurae, and even in tympany (bloating), either from pressure or the presence of toxic gases in the circulation, and in all congestive or inflammatory diseases of the kidneys, acute or chronic.

Casts of the uriniferous tubes and epithelial and pus cells can be seen only by placing the suspected urine under the microscope. Casts are usually very elastic and mobile, waving about in the liquid when the cover glass is touched, and showing a uniform, clear transparency (waxy) or entangled circular epithelial cells or opaque granules or flattened, red blood globules or clear, refrangent oil globules. They may be even densely opaque from crystals of earthy salts.

DIURESIS (POLYURIA, DIABETES INSIPIDUS, OR EXCESSIVE SECRETION OF URINE)

Diuresis consists in an abnormally increased secretion of urine, which is usually paler in color than normal, contains fewer solids than the normal fluid, and hence is of low specific gravity (as low as 1.007). It is a symptom rather than a disease.

Causes.—Its causes may be any agent—medicinal, alimentary, infectious, metabolic, or poisonous—that induces an increased flow of blood through the kidneys or that overstimulates these organs. Among the several medicinal agents that increase the flow of urine are turpentine and potassium nitrate. Such drugs are useful in experienced hands but when injudiciously employed they may be actually harmful. Long-continued administration of these diuretics or overdoses of them may incite an active congestion of the kidney and, finally, chronic inflammation, which may be difficult to remedy. Damaged feeds, such as improperly cured hay or straw, frozen forage, or moldy grains, are perhaps the most common causes of polyuria in horses. Excessive secretion of urine, due either to direct infection or indirect overstimulation of the kidneys, is a common symptom of infectious anemia, chiefly the acute type, and is sometimes observed in glanders and tuberculosis. In such infections, inflammatory and degenerative changes as well as the congestion are usually present. Horses continuously kept at hard work and stallions appear to be more disposed to the condition. For some reason it is apparently more common in the summer than in the winter. Finally, large quantities of roots or other feeds containing high percentages of water, a full allowance of salt to animals that have become inordinately fond of it, and disturbances of the heat-regulating mechanism, which impair the faculty of free sweating, may cause the overworking of the kidneys with a corresponding increase in flow of urine.

Symptoms.—The horse drinks abnormally large quantities of water and urinates frequently, particularly during the day when at work. The fluid is usually paler than normal, of low density, and without the usual distinctive odor of horse urine. In short, it contains a great excess of water and a deficiency of the usual solid parts. The quantity of fluid, however, is so great that the actual amount of solids passed within a day greatly exceeds the normal. The horse may show some stiffness of the back and the hindquarters. If the cause is not removed, a progressive loss of flesh and finally extreme emaciation and weakness may develop; the coat loses its luster, the animal becomes hidebound and has little endurance. The animal may survive for months or may die early of exhaustion. Less severe cases may slowly recover if the causative agent is eliminated.

Treatment.—Treatment consists in stopping the ingestion of the faulty drugs, poisons, or feed, and supplying sound hay and grain free from all taint of heating or mustiness. A liberal supply of boiled flaxseed in the drinking water at once serves to assist in the elimination of the poison and to soothe and protect the irritated kidneys. A laxative dose of Epsom or Glauber's salt (one-quarter to one-half pound) or a quart of mineral oil will mildly stimulate excretion by the bowels and tend to lessen the burden on the kidneys. Agents that irritate the kidneys should be avoided. The animal should be kept warm and allowed only small quantities of water at frequent intervals. It should be allowed to rest until strength is restored. The feed should consist of easily digested, laxative feeds, such as gruels, mashers, and small quantities of bright clean hay or meager portions of freshly cut grass. If the condition does not improve shortly, one should not further delay in calling a veterinarian.

DIABETES MELLITUS (GLYCOSURIA, GRAPE SUGAR IN THE URINE)

In the body tissues, the carbohydrates and small portions of the protein in the feed consumed are converted into sugar, part of which is used for energy and maintenance of body temperature. The unused portion of the sugars is converted into another form, the so-called glycogen, which is stored in the body tissues, chiefly the muscles and the liver. The blood in healthy horses carries sugar in the form of grape sugar or glucose to the extent of about 0.1 percent of its volume. This sugar is removed from the blood according to the nutritive demands of the tissues, and in a properly balanced metabolism the sugar content of the blood is practically constant and little or no sugar is excreted by the kidneys in the urine. "Diabetes mellitus" is the term used to designate that diseased state in mammals in which sugar is continuously excreted in the urine.

Cause.—Diabetes mellitus is induced by a disturbance of the balance of the body processes that regulate sugar metabolism. This metabolism is a peculiar and not completely understood process, which is believed to be regulated by the working together of a center at the base of the brain, of the pancreas (known as the abdominal sweetbread in animals used for food) and probably other glands having internal secretions, and of the liver. Any disease that involves any of these organs or glands may induce diabetes mellitus, which is not to be confused with the glycosuria that follows the ingestion of particularly large quantities of carbohydrates and sugars and that is transitory in nature. The same temporary state may at times follow prolonged anesthesia and many forms of poisoning. True diabetes mellitus has been only rarely recognized in horses and then usually only when the animals have become emaciated and extremely

weak. Possibly more frequent examinations of the urine in cases of a nature suspicious of the disease might reveal the condition more often.

Symptoms.—Aside from the presence of sugar in the urine, which may be detected by appropriate tests best conducted in a laboratory, there are no particularly characteristic symptoms of this disease. The disease nearly always develops gradually. At first the animals show some dullness; they tire easily and may perspire unduly even when not working. The urine is usually increased in quantity and is discharged at brief intervals; it is usually pale in color; the sugar content is variable but is usually high in cases that are not recognized before the disease is well advanced. In advanced diabetes, dropsies of various parts of the body, catarrhal bronchitis, emaciation, drowsiness, and a weak, staggering gait are often observed. In the last stages, unconsciousness develops and the animals may die after coma or a state of convulsions appears.

Treatment.—This depends on the direct cause, which obviously may be very difficult of determination. When the disease is discovered early, the supply of carbohydrates should be limited and the feed should consist chiefly of products relatively rich in protein and fats. If long-continued, however, the use of these feeds may cause an acidosis with the presence of acetone in the blood and urine (acetonemia), thus necessitating the addition of carbohydrates to the diet. Some animals may improve if they are placed on pasture and rested. An ounce of common baking soda may be added to the drinking water twice a day. Valuable animals may be treated with insulin, an extract made from the pancreas. This is not economically practical with the average horse since it may be necessary to continue the extract over extended periods of time.

HEMATURIA (BLOODY URINE)

Causes.—As seen in the horse, bloody urine is usually the direct result of mechanical injuries, as sprains and fractures of the loins, lacerations of the sublumbar muscles (psoas), irritation caused by stone in the kidney, ureter, bladder, or urethra. However, it may occur with acute congestion or inflammations of the kidney, with tumors in its substance, or with papilloma or other diseased growth in the bladder. Acrid diuretic plants in the feed may also lead to the escape of blood from the kidney.

The blood may be present in small clots or in more or less intimate admixture with the urine. Its condition may furnish some indication as to its source; thus, if from the kidneys it is more likely to be uniformly diffused through the urine, whereas if it comes from the

bladder or passages, clots are more likely to be present. Again, in bleeding from the kidney, minute, cylindrical clots enclosing blood globules and formed in the uriniferous tubes can be detected under the microscope. Further information as to its source may be obtained by observing whether there is coexisting fracture, sprain of the loins, or stone or tumor in the bladder or urethra. Blood may be found in the urine of horses affected by an acute attack of infectious anemia, in which cases the urine may be very dark in color and oily in consistence. (The discolored urine that occurs in azoturia must not be mistaken for hematuria. Hematuria occurs relatively infrequently in horses, whereas azoturia is common.)

Treatment.—Since hematuria in the horse is mainly due to direct injury, treatment consists, first, in removing such cause whenever possible, and then in applying general and local medication. Irritants in feed must be avoided, sprains appropriately treated, and stone in bladder or urethra removed. Mucilaginous drinks and styptics are sometimes given. If the discharge is abundant, apply cold water to the loins and keep the animal perfectly still. In some cases the injection, beneath the skin or into the vein, of solutions intended to stop hemorrhage or to replace some of the lost essential constituents of the blood may be resorted to by the veterinarian.

AZOTURIA (HEMOGLOBINURIA MYOGLOBINURIA, LUMBAGO, BLACK WATER)

Azoturia is familiar to many horsemen also as "Monday morning sickness." It is a specific acute affection of horses, characterized by severe disturbance in locomotion and the presence of pigment in the urine.

Cause.—Because of the stained urine and the tightened muscles of the loins and hind legs, the common idea was that this was a disorder of the urinary organs. Veterinary investigators have shown, however, that the urinary disturbance is only secondary to a general state of the body, and, therefore, is but a symptom of the basic disease. Extensive studies of the blood, muscles, and urine in this ailment have been made and numerous theories have been advanced as to the exact cause of the condition. Although there is not complete agreement as to the cause, it may be stated, in a general way, that some toxin originating in the metabolic processes of the body is in some way responsible. The conditions favorable to the development of the disease are created in animals in good condition that have been stabled on full rations and without work or exercise for 1 or more days. Draft horses are mainly affected, although others occasionally develop the disease.

Symptoms.—Within a few minutes to an hour after beginning work or exercise, the affected animal shows signs of stiffness or cramping of the muscles; it is reluctant to move and breaks out in a sweat. The lameness, frequently attended by trembling, is usually of the hind legs or the loins but may be in one shoulder. These symptoms continue, particularly if the animal is forced to continue moving, and finally the horse is no longer able to stay on its feet—it may sit on the haunches like a dog or completely collapse, falling on the side. At these times symptoms of colic may be evident. Repeated violent efforts to rise are made, and the animal is bathed in perspiration and finally becomes exhausted. The temperature is about normal but may be elevated late in a severe attack; the respiration is labored; the mucous membranes are highly reddened and sometimes yellow; the affected muscles are hard and unyielding when palpated; bowel movements and urination are usually retarded; the urine when passed is red or brown to almost black in color and thick in consistence. When once down and unable to rise, few animals recover, except by particularly diligent treatment, including nursing. Death terminates especially severe cases in a few hours to a few days. The symptoms shown by individual cases may at times closely resemble those seen in severe colic or in an acute brain disease as, for example, encephalomyelitis.

Treatment.—The first consideration in the treatment of azoturia is that every added effort that is required of the horse after it first shows symptoms lessens the chance of recovery. Wherever and whenever the disease is discovered, it is advisable to keep the animal absolutely at rest. Every effort to keep it on its feet should be made and yet the animal should not be walked. If the horse is down, it may be bedded in deep straw where it lies or moved on a sled or low wagon to a more convenient location. Shelter from the sun and blanketing in the winter are desirable. The animal should be turned over every few hours and, if the bladder is greatly distended, catheterization is usually resorted to. It is sometimes necessary to administer sedatives to keep the animal quiet, in addition to the proper laxative. Severe cases require almost constant attention. To assist the animal in overcoming the toxic substances of the disease, injections into the vein are often used. Prolonged cases sometimes require the use of stimulants that are preferably administered by means of the stomach tube or hypodermically. Those mild cases of the disease that recover before severe symptoms develop should be placed on a restricted laxative ration for a few days and given a graduated amount of exercise after 3 or 4 days.

Prevention.—The prevention of this serious affection lies in restricting the diet and giving daily exercises when the animal is not

at work. An animal that has had one attack should never be left idle for a single day in the stall or barnyard. When a horse has been idle for several days and on full feed, it may be given a laxative ($\frac{1}{2}$ to 1 pound of Glauber's salt) and graduated exercise, beginning with a short walk and increasing day by day.

ACUTE INFLAMMATION OF THE KIDNEYS (ACUTE NEPHRITIS)

Inflammations of the kidneys have been differentiated widely, according to whether they were acute or chronic, parenchymatous or tubal, suppurative or not, with increased or shrunken kidney tissue. In the present work, however, inflammations have been classed under acute and chronic.

Causes.—The causes of inflammation of the kidneys are extremely varied. Congestion occurs from the altered and irritant products passed through these organs during the course of infectious diseases and recovery from inflammations of other organs and during fevers. This may last only during the existence of its cause or may persist and become aggravated. Heart disease, throwing the blood pressure back on the veins and kidneys, is another cause. Disease of the ureter or bladder, preventing the escape of urine from the kidney and causing increased fullness and tension in its pelvis and tubes may incite inflammation. Decomposition of the retained urine in such cases and the production of ammonia and other irritants must also be named. In elimination of bacteria through the kidney, the latter is liable to infection with consequent inflammation. The advance of bacteria upward from the bladder to the kidneys is another cause. The consumption in hay or other fodder of acrid or irritant plants and chemicals, the absorption of cantharidine from a surface blistered by Spanish flies, the reckless administration of diuretics, the presence of stones in the kidney, and the infliction of blows or sprains on the loins, may contribute to its production. Liver disorders that throw on the kidneys the work of excreting irritant products, diseases of the lungs and heart from which clots are carried, to be arrested in the small blood vessels of the kidney, and injuries and paralysis of the spinal cord, are additional causes. Inflammation and degenerative changes in the kidneys frequently occur in infectious anemia and to some extent in distemper and influenza.

Symptoms.—The symptoms are more or less fever, manifest stiffness of the back and straddling gait with the hind legs, difficulty in lying down and rising or in walking in a circle, the animal sometimes groaning under the effort, arching of the loins and tucking up of the flank, looking back at the abdomen as if from colicky pain, and tenderness of the loins to pinching, especially just beneath the bony processes 6 inches to one side of the median line. Urine is passed

frequently, usually a small quantity at a time, of a high color, and sometimes mixed with blood or even pus. If treated by acetic acid, boiling, and subsequent addition of strong nitric acid, the resulting and persistent precipitate indicates the amount of albumin. The legs tend to swell from the foot up, also the dependent parts beneath the belly and chest, and effusions of liquid may occur within the chest or abdomen. In the male the alternate drawing up and relaxation of the testicles in the scrotum are suggestive, and in small horses the oiled hand introduced into the rectum may reach the kidney and ascertain its sensitiveness. The existence of nephritis in some cases can be recognized positively only by means of a complete analysis of the urine, which includes microscopic examination.

Treatment.—The first step is the removal of any recognized cause. Next relieve the kidneys as far as possible by throwing their work on the bowels and skin. Large doses of Epsom or Glauber's salt, or aloes, or even of castor oil, should not be given because of their irritating effect on the kidneys. A quart of liquid petrolatum may be given daily for 3 to 5 days during which time the feed, water, and salt should be reduced to a minimum if the flow of urine is profuse. On the other hand, if there is scanty urine the animal should be encouraged to drink as much water as possible, and lightly salted bran mashes, as well as other laxative and succulent feeds, may be given. To increase skin activity a warm stall and liberal covering should be supplied.

Boiled flaxseed may be added to the drinking water, also injected into the rectum, and blankets saturated with hot water may be persistently applied to the loins. A very thin paste of the best ground mustard mixed with tepid water, may be rubbed in against the direction of the hair and covered with paper and a blanket. This may be kept on for an hour, or until the skin thickens and the hair stands erect. It may then be rubbed or sponged off and the blanket reapplied. When the action of the bowels has been started, it may be kept up by a daily dose of 2 or 3 ounces of Glauber's salt.

During recovery, the patient should be guarded against cold, wet, and any active exertion for some time after all active symptoms have subsided.

The treatment of nephritis is not a mere rule-of-thumb procedure. Commonly, unqualified persons "guess that there is something the matter with the kidneys" and give actually harmful drugs.

CHRONIC INFLAMMATION OF THE KIDNEYS

Causes.—Chronic inflammation of the kidneys is more commonly associated with albumin and casts in the urine than the acute form, and in some instances these conditions of the urine may be the only

prominent symptoms of the disease. Though it may supervene on injuries, it is much more commonly connected with faulty conditions of the system—as indigestion, heart disease, lung or liver disease, imperfect blood formation or assimilation, or in the course of the specific infectious diseases; in short, it is rather the attendant on a constitutional infirmity than on a simple local injury.

It may be associated with various forms of diseased kidneys, as shrinkage (atrophy), increase (hypertrophy), softening, red congestion, or white enlargement, so that it forms a group of diseases rather than a disease by itself.

Symptoms.—The symptoms may include stiffness, weakness, and increased sensibility of the loins and modified secretion of urine (increase or suppression), or the flow may be natural. Usually it contains albumin, the quantity furnishing a fair criterion of the gravity of the affection, and microscopic casts, also most abundant in serious cases. Dropsy, manifested in swollen legs, is a significant symptom, and if the effusion takes place along the lower line of the body or in the chest or abdomen, the significance is increased. A scurfy, unthrifty skin, lack-luster hair, inability to sustain severe or continued exertion, poor or irregular appetite, loss of fat and flesh, flabbiness of the muscles, and pallor of the membranes of the eyes, and nose are equally suggestive. So are skin eruptions of various kinds. Any one or more of these symptoms would warrant an examination of the urine for albumin and casts, the finding of which signifies renal inflammation.

Treatment.—This is not always satisfactory as the cause is likely to be maintained in the disorders of important organs elsewhere. If any such coincident disease of another organ or function can be detected, that should be treated first or simultaneously with this affection of the kidneys. In all cases the building up of the general health is important. Hence a course of tonics may be given. If there is any elevated temperature of the body and tenderness of the loins, fomentations may be applied, followed by a mustard plaster, as for acute inflammation, and even in the absence of these indications mustard or some other so-called counterirritant may be resorted to with advantage at intervals of a few days. In suppression of urine, fomentations with warm water or with infusions of certain drugs is a safer resort than diuretics.

As in acute inflammation, every attention should be given to provide warm covering, a warm stall, proper feed, and pure air.

TUMORS OF THE KIDNEYS

Tumors, whether malignant or simple, may give rise to symptoms resembling some form of inflammation but are often not recognized during life.

PARASITES

To parasites of the kidney belong the echinococcus, the larval, or bladder worm, stage of the small echinococcus tapeworm of the dog. *Diocotophyme renale*, the largest of roundworms, has been found in the kidney of the horse. Its presence can be certified only by the passage of its microscopic eggs or of the entire worm. Immature stages of roundworms, either *Strongylus equinus* or a related species, *S. edentatus*, and *S. vulgaris*, may be found in the renal artery or in the kidney itself.

SPASM OF THE NECK OF THE BLADDER

This affection consists in spasmodic closure of the outlet from the bladder by tonic contraction of the circular muscular fibers. It may be accompanied with a painful contraction of the muscles on the body of the bladder; or, if the organ is already unduly distended, these will be affected with temporary paralysis. It is most frequent in the stallion or gelding but by no means unknown in the mare.

Causes.—The causes are usually hard and continuous driving without opportunity for passing urine, cold rainstorms, drafts of cold air when the animal is perspiring and fatigued, the administration of Spanish fly or the application of extensive blisters of the same, abuse of diuretics, the presence of acrid, diuretic plants in the fodder, and the presence of stone in the bladder. Continued irritation caused by various poisons, infection, or the presence of small or large stones may cause a sympathetic, reflex contraction of the neck of the bladder. As many mares refuse to urinate while in harness, these should be unhitched at suitable times for urination. Spasms of the bowels are usually attended by spasm of the bladder, hence the free passage of water is usually a symptom of relief.

Symptoms.—The symptoms are frequent stretching and straining to urinate, with no result or a slight dribbling only. These vain efforts are attended by pain and groaning. On resuming its natural position the animal is not freed from the pain but moves uneasily, paws, shakes the tail, kicks at the abdomen with the hind feet, looks back to the flank, lies down and rises, arches the back, and attempts to urinate as before. If the oiled hand is introduced into the rectum the greatly distended bladder may be felt beneath, and the patient will often cringe when it is handled.

Irritation of the urinary organs is often present in impaction of the colon with solid matters, because the impacted intestine under the straining of the patient is forced backward into the pelvis and presses upon and irritates the bladder. In such cases the animal stands with its forelegs advanced and the hind ones stretched back beyond the natural posture and makes frequent efforts to urinate, with varying

success. Unpracticed observers naturally conclude that the secondary urinary trouble is the main and only one, and the intestinal impaction and obstruction is often neglected until it is irremediable. In cases in which the irritation has caused spasm of the neck and bladder and overdistention of that organ, the mistake is still more easily made; hence it is important in all cases to examine for the impacted bowel, forming a bend or loop at the entrance of the pelvis and usually toward the left side. The impacted intestine feels soft and doughy and is easily indented with the knuckles, forming a marked contrast with the tense, elastic, resilient, overdistended bladder.

Similar symptoms may be caused by a stone or sebaceous mass, by a stricture obstructing the urethra, or in the newborn by thickened mucus in that duct and by the pressure of hardened, impacted feces in the rectum. In obstruction, the hard, impacted body can usually be felt by tracing the urethra along the lower and posterior surface of the penis and forward to the median line of the floor of the pelvis to the neck of the bladder. That part of the urethra between the seat of obstruction and the bladder is usually distended with urine and feels enlarged, elastic, and fluctuating.

Treatment.—Treatment may be begun by taking the animal out of harness. If this fails to produce the desired effect, spread clean litter beneath the belly or turn the patient out on the manure pile. If rest and quiet alone do not alleviate the symptoms, and a veterinarian is not available, a $\frac{1}{2}$ - to 1-dram dose of fluid extract of belladonna may relax the organ if the spasm is not due to spinal injury. In the mare the neck of the bladder may be dilated by inserting two oiled fingers and slightly parting them. In the horse the oiled hand introduced into the rectum may press from before backward on the anterior or blind end of the bladder. Finally, a clean, well-oiled, flexible catheter may be entered into the urethra through the papilla at the end of the penis and pushed on carefully until it has entered the bladder. To effect this the penis must first be withdrawn from its sheath, and when the advancing end of the catheter has reached the bend of the urethra beneath the anus it must be guided forward by pressure with the hand, which guidance must be continued onward into the bladder, the oiled hand being introduced into the rectum for this purpose. The horse catheter, $3\frac{1}{2}$ feet long and one-third inch in diameter, may be bought from a surgical-instrument maker. Its use, however, is a technical procedure which, except in emergency, should be entrusted only to a veterinarian.

PARALYSIS OF THE BLADDER

Paralysis of the body of the bladder with spasm of the neck has been described under the last heading and may occur in the same

way from overdistention in tetanus, acute arthritis, paraplegia, and hemiplegia, in which the animal cannot stretch itself to urinate, and in cystitis, or inflammation of the bladder. It also occurs as a result of disease of the posterior end of the spinal cord and with a broken back and is then associated with paralysis of the tail, and, it may be, of the hind legs.

Symptoms.—There is dribbling of urine, the liquid running down the inside of the thighs and irritating the skin, or the urine may be retained until the bladder is greatly overdistended and then expelled in a gush by the active contraction of the muscular walls of the abdomen. This never empties the bladder, however, and the oiled hand introduced through the rectum may feel the soft, flabby organ still half full of urine. This retained urine is likely to decompose, affect the epithelial cells, and expose the raw mucous membrane. Suppression and incontinence of urine are common also to obstruction of the urethra by stone or otherwise; hence this source of fallacy should be excluded by manual examination along the whole course of that duct.

Treatment.—Treatment is applicable only in cases in which the determining cause can be abated. In remediable sprains of the back or disease of the spinal cord, these must have appropriate treatment and the urine must be drawn off frequently with a catheter to prevent overdistention and injury to the bladder. If the paralysis persists after recovery of the spinal cord, or if it continues after relief of spasm of the neck of the bladder, a mustard plaster may be applied over the back part of the belly in front of the udder and covered with a blanket until the hair stands erect. In the male the mustard may be applied between the thighs from near the anus downward. Stimulant drugs or electricity for restoration of normal tone of the bladder may be administered.

INFLAMMATION OF THE BLADDER (CYSTITIS OR UROCYSTITIS)

Cystitis may be slight or severe, acute or chronic, partial or general. It may be caused by misuse of certain drugs; the presence of a stone or gravel in the bladder; the irritation of a catheter or other foreign body introduced from without; infection introduced on a filthy catheter, the overdistention of the bladder by retained urine, resulting in destruction of the epithelial cells and irritation of the raw surface; or a too concentrated and irritating urine. The application of such irritants as cantharides (Spanish fly), turpentine, or mercury compounds over a too extensive surface, sudden exposure of a perspiring and tired horse to cold or wet, and the presence of acrid plants in the fodder may cause cystitis, as well as nephritis. Finally, inflammation may extend from a diseased kidney, uterus,

vagina, or urethra to the bladder, and may result from several specific infections such as distemper, swamp fever, glanders, or tuberculosis.

Symptoms.—The symptoms are slight or severe colicky pains; the animal moves its hind feet uneasily or even kicks at the abdomen, looks around at the flank, and may even lie down and rise frequently. More characteristic are frequently repeated efforts to urinate, resulting in the discharge of a little clear or red or, more commonly, flocculent urine, usually in jets, and accompanied with signs of pain, which persists after the discharge, as shown in continued straining, groaning, and perhaps in movements of the feet and tail. The penis hangs from the sheath, or in the mare the vulva is frequently opened and closed. The animal winces when the abdomen is pressed in the region of the sheath or udder, and the bladder is found to be sensitive and tender when pressed with the oiled hand introduced through the rectum or vagina. In the mare the thickening of the walls of the bladder may be felt by introducing one finger through the urethra. The discharged urine, which may be turbid or oillike, contains an excess of mucus, with flat shreds of membrane, with scaly epithelial cells, and pus corpuscles, but there are no microscopic tubular casts, as in nephritis. If due to stone in the bladder, that will be found on examination through the rectum or vagina.

Treatment.—This consists, first, in the removal of the cause, whether poisons in feed or as medicine, cantharides (Spanish fly) or other blistering agents from the skin, infections, or calculi. If the urine has been retained and decomposed, it should be completely evacuated through a clean catheter, and the bladder may be thoroughly washed out with a mild antiseptic solution. This should be repeated until the urine no longer decomposes, because as long as there is decomposition in the bladder the protecting layer of epithelial cells will be damaged and the surface kept raw and irritated. The diet should be light (bran mash, roots, fresh grass). Certain drugs classed as urinary antiseptics may be given by mouth or injected into the blood stream, or may be used in irrigating the bladder. Fomentations over the loins are sometimes of advantage, and these may be followed or alternated with the application of mustard, as in paralysis; or the mustard may be applied on the back part of the abdomen below or between the thighs from the anus downward. Finally, when the acute symptoms have subsided, tonics may be given which serve to restore lost tone to the bladder.

IRRITABLE BLADDER

Some horses, especially mares, show an irritability of the bladder and nerve centers presiding over it by frequent urination in small quantities, though the urine is not manifestly changed in character

and no more than the natural quantity is passed in 24 hours. The disorder appears to have its source as frequently in the genital, glandular, or nervous systems as in the urinary. A troublesome and dangerous form is seen in mares, which dash off and refuse all control by the rein if driven with a full bladder, but usually are docile if the bladder has been emptied before hitching. In other cases the excitement connected with getting the tail over the reins is a powerful determining cause. The condition is marked in some mares during the period of heat or in nymphomaniacs.

An oleaginous laxative (castor oil 1 pint) will serve to remove any cause of irritation in the digestive organs, and a careful dieting will avoid continued irritation by acrid vegetable agents. The bladder should be examined to see that there is no stone or other cause of irritation, and the sheath and penis should be washed with soapsuds, any sebaceous matter removed from the bilocular cavity at the end of the penis, and the whole lubricated with olive oil. Irritable mares should be induced to urinate before they are harnessed, and those that clutch the lines under the tail may have the tail set high by cutting the cords on its lower surface, or it may be prevented from getting over the reins by having a strap carried from its free end to the breeching.

In some cases of glandular disturbance the nervousness and excitability may be remedied by the administration of extracts of certain glands. Mares proving too troublesome when in heat may be given sedatives or they may be served by the male or spayed.

DISEASED GROWTHS IN THE BLADDER

These may be of various kinds, malignant or simple. In the horse villous growths from the mucous membrane have been found to be especially troublesome. They may be attached to the mucous membrane by a narrow neck or by a broad base covering a great part of the organ.

Symptoms.—The symptoms are frequent straining, and passing of urine and blood occasionally with gravel. An examination of the bladder with the hand in the rectum may serve in the detection of the new growth, which may be distinguished from a hard, resistant stone. In mares, in which the finger can be inserted into the bladder, the recognition is more satisfactory. Polypi attached by narrow necks may be removed by surgical operation in some cases, but in most cases such treatment is unsatisfactory or impractical. There is no known medicine that will effectively and permanently remove these growths.

DISCHARGE OF URINE BY THE NAVEL (PERSISTENT URACHUS)

This occurs only in the newborn and consists in the nonclosure of the natural channel (urachus), through which the urine is discharged

into the outer water bag (allantois) in fetal life. At that early stage the bladder resembles a long tube, which is prolonged through the navel string and opens into the outermost of the two water bags in which the fetus floats. In this way the urine is prevented from entering the inner water bag (amnion), where it would mingle with the liquids, bathing the skin of the fetus, and cause irritation. At birth this channel closes up, and the urine takes the course normal to extrauterine life. Imperfect closure is more frequent in males than in females, because of the great length and small caliber of the male urethra and its consequent tendency to obstruction. In the female there may be a discharge of a few drops only at a time, whereas in the male the urine will be expelled in strong jets coincidentally with the contractions of the bladder and walls of the abdomen.

The first care is to ascertain whether the urethra is pervious by passing a small catheter. This determined, the open urachus may be firmly closed by properly applied sutures. If a portion of the navel string remains, the tying of that may be sufficient. It is important to tie as early as possible to avoid inflammation of the navel from contact with the urine.

EVERSION OF THE BLADDER

Eversion of the bladder can occur only in the female. It consists in the turning of the organ inside out through the channel of the urethra, so that it appears as a red, pear-shaped mass hanging from the floor of the vulva and protruding externally between its lips. It may be a mass like the fist, or it may swell to the size of an infant's head. On an examination of its upper surface the orifices of the ureters may be seen, one on each side, a short distance behind the neck, with the urine oozing from them drop by drop.

This displacement supervenes on a flaccid condition of the bladder, the result of paralysis, overdistention, violent straining, severe compression occurring in difficult parturition, or other conditions.

The replacement of the everted organ usually requires the services of a veterinarian. But if a veterinarian cannot be obtained, the protruding organ may be washed with an antiseptic solution, such as a teaspoonful of carbolic acid in a quart of water, and attempts made to return it by pressing a clean, smooth, rounded object into the fundus and directing it into the urethra, while careful pressure is made on the surrounding parts with the other hand. If too large and resistant, it may be wrapped firmly in a strip of bandage about 2 inches broad to express the great mass of blood and exudate and diminish the bulk of the protruded organ so that it can be pushed back. This method has the additional advantage of protecting the organ against bruises and lacerations in the effort to return it. The earlier that attention

is given these cases the better. After the return, straining may be kept in check by giving sedatives, by applying a truss to press upon the lips of the vulva, or by anesthesia. (See Eversion of the Womb, p. 189.) The patient should be kept quiet in a stall a few inches lower in front than behind, so that the action of gravity will favor retention.

INFLAMMATION OF THE URETHRA (URETHRITIS, OR GLEET)

This affection belongs as much to the genital organs, yet it cannot be entirely overlooked in a discussion on urinary disorders. It may be induced by the same causes as cystitis (p. 129); by the passage and temporary arrest of small stones or gravel; by the irritation caused by foreign bodies introduced from without; by blows on the penis by sticks, stones, or by the feet of a mare that kicks while being served; by an infecting inflammation contracted from a mare served in the first few days after parturition or one suffering from leucorrhea or other infections; by infective material introduced on a dirty catheter; or by the extension of inflammation from an irritated, bilocular cavity filled with hardened sebaceous matter, or from an uncleansed sheath.

Symptoms.—The symptoms are swelling, heat, and tenderness of the sheath and penis; difficulty, pain, and groaning in passing urine, which is likely to sudden temporary arrests in the course of micturition, and later a whitish, mucopurulent oozing from the papilla on the end of the penis. There is a tendency to erection of the penis, and in cases contracted from a mare the outer surface of that organ will have more or less extensive sores and ulcers. Stallions suffering in this way may refuse to mount or, having mounted, fail to complete the act of coition. If an entrance is effected, infection of the mare is likely to follow.

Treatment.—In the early stages a dose of physic may be given and warm fomentations may be applied to the sheath and penis. If infection is present, the urethra may be injected with suitable antiseptic preparations. When mucopurulent discharge appears astringent injections may be used, the same being applied to the surface of the penis and inside the sheath.

Every stallion suffering from urethritis should be withheld from service, as should mares with leucorrhea.

STRICTURE OF THE URETHRA

A permanent narrowing of the urethra at a given point is the result of previous inflammation caused by the passage or arrest of a stone or gravel, by strong astringent injections in the early nonsecreting stage of urethritis, or by contraction of the lining membrane occurring during the healing of aggravated or neglected inflammations of that

canal. The trouble is shown by the passage of urine in a fine stream, with straining, pain, and groaning, and by frequent painful erections. It must be remedied by mechanical dilation, with catheters just large enough to pass with gentle force, to be inserted once a day; larger catheters to be used as the passage will admit them. The catheter must be kept perfectly clean and washed in antiseptic solution and well lubricated before it is introduced.

URINARY CALCULI (STONE OR GRAVEL)

These consist of some of the solids of the urine that have been precipitated from the urine in the form of crystals, which remain apart as a fine, powdery mass, or magma, or aggregate into calculi, or stones, of varying size (pl. XI). Their composition is therefore determined in different animals by the salts or other constituents found dissolved in the healthy urine and by the additional constituents that may be thrown off in solution in the urine in disease. The following is an analysis of the horse's urine in health:

	<i>Percent</i>
Water.....	91. 85
Urea.....	1. 34
Uric acid and urates.....	. 01
Hippuric acid.....	2. 64
Lactic acid and lactates.....	. 12
Mucus and organic matter.....	2. 20
Sulfates (alkaline).....	. 12
Phosphates (calcium and sodium).....	. 02
Chlorides (sodium).....	. 10
Carbonates (potassium, magnesium, calcium).....	1. 60
Total.....	100. 00

The calcium carbonate, which is present in large quantity in the urine of horses fed on green fodder, is practically insoluble and therefore forms in the passages after secretion, and its microscopic, rounded crystals give the urine of such horses a milky whiteness. This material constitutes the soft, white pultaceous mass that sometimes fills the bladder to repletion and must be washed out. In hay-fed horses carbonates are still abundant, whereas in those mainly grain fed they are replaced by hippurates and phosphates—the products of the wear of tissues—the carbonates being the result of oxidation of the vegetable acids in the feed. Calcium carbonate, therefore, is a very common constituent of urinary calculi in herbivora and in many cases is the most abundant solid constituent.

Calcium oxalate, like calcium carbonate, is derived from the burning up of the carbonaceous matter of the feed in the system, one important factor being the less perfect oxidation of the carbon. Indeed, Füssenberg and Schmidt have demonstrated on man, horses, cattle, and rabbits that under the full play of the oxidizing (breathing) forces

oxalic acid, like other organic acids, is resolved into carbonic acid. In keeping with this is the observation of Lehmann, that in all cases in which man suffered from interference with oxidation, calcium oxalate appeared in the urine. An excess of calcium oxalate in the urine, however, may have a different origin. Uric and hippuric acids, respectively, are found in the urine of carnivora and herbivora, as the result of the healthy wear (disassimilation) of nitrogenous tissues. If these products are fully oxidized, however, they are thrown out in the form of the more soluble urea rather than as these acids. When uric acid out of the body is treated with peroxide of lead it is resolved into urea, allantoin, and oxalic acid, and Woehler and Frerichs found that the administration of uric acid not only increased the excretion of urea but also of oxalic acid. It may therefore be inferred that oxalic acid is not produced from the carbonaceous feed alone but also from the disintegration of the nitrogenous tissues of the body. An important element of its production is, however, the imperfect performance of the breathing functions, and hence it is likely to result from diseases of the chest, such as heaves, and chronic bronchitis. This is, above all, likely to be the case if the subject is fed to excess on highly carbonaceous feeds.

Magnesium carbonate, another almost constant ingredient of the urinary calculi of the horse, is formed in the same way as the calcium carbonate—from the excess of carbonaceous feed (organic acids) becoming oxidized into carbon dioxide, which unites with the magnesia derived from the feed.

The phosphates of calcium and magnesium are not abundant in urinary calculi of the horse, the phosphates being present to excess in the urine in only two conditions—(a) when the ration is excessive and especially rich in phosphorus (wheat, bran, beans, peas, vetches, rape cake, oil cake, cottonseed cake); and (b) when, through the morbid, destructive changes in the living tissues, and especially of the bones, a great quantity of phosphorus is given off as a waste product. Under these conditions, however, the phosphates may contribute to the formation of calculi, and this especially is likely if the urine is retained in the bladder until it has undergone decomposition and given off ammonia. The ammonia at once unites with the phosphate of magnesia to form a double salt—phosphate of ammonia and magnesia—which, being insoluble, is at once precipitated. The precipitation of this salt, however, is rare in the urine of the horse, being much more frequent in that of man and sheep.

These are the chief mineral constituents of the urine that form ingredients in the horse's calculi, for though iron and manganese are usually present they are in only minute quantities.

The excess of mineral matter in a specimen of urine unquestionably contributes to the formation of calculi, just as mineral matter in a

solution out of the body tends to crystallize as the solution becomes more concentrated and approaches saturation. Hence, in considering the causes of calculi one cannot ignore the factor of an excessive ration, rich in minerals and in carbonaceous matter (the source of carbonates and much of the oxalates), nor can one overlook the concentration of the urine resulting from dry feed and privation of water, or from fever, which causes suspension of the secretion of water. In these cases, at least the usual quantity of solids is thrown off by the kidneys, and as the water is diminished there is danger of its approaching the point of supersaturation, when the dissolved solids must necessarily be deposited. Hence, calculi are more common in stable horses fed on dry grain and hay, in those denied a sufficiency of water or that have water supplied irregularly, in those subjected to profuse perspiration (as in summer), and in those suffering from a watery diarrhea. On the whole, calculi are most commonly found in winter, because the horses are then on dry feeds, but dry feeding is even more conducive to them in summer when the condition is aggravated by the great loss of water by the skin.

In the same way the extreme hardness of the water in certain districts must be looked upon as contributing to the concentration of the urine and correspondingly to the production of stone. The carbonates, sulfates, etc., of calcium and magnesium taken in the water must be again thrown out, and just in proportion as these add to the solids of the urine they dispose it to precipitate its least soluble constituents. Thus the horse is subject to calculi on certain limestone soils, as over the calcareous formations of central and western New York, Pennsylvania, and Ohio, in the United States; of Norfolk, Suffolk, Derbyshire, Shropshire, and Gloucestershire, in England; of Poitou and Landes, in France; and Munich, in Bavaria.

The saturation of the urine from any or all of these conditions can be looked on only as an auxiliary cause, however, and not as in itself the primary one, except on the rarest occasions. For a more direct and immediate cause one must look to the organic matter that forms a large proportion of all urinary calculi. This consists of mucus, albumin, pus, hyaline casts of the uriniferous tubes, epithelial cells, blood, etc., mainly agents that belong to the class of colloid or noncrystalline bodies. A horse may live for years with the urine habitually of a high density and having the mineral constituents in excess without the formation of stone or gravel; again, one with dilute urine of low specific gravity may have a calculus.

Rainey, Ord, and others furnish the explanation. They not only show that a colloid body, such as mucus, albumin, pus, or blood, determine the precipitation of the crystalline salts in the solution, but they determine the precipitation in the form of globules, or spheres,

capable of developing by further deposits into calculi. Heat intensifies this action of the colloids, and a colloid in a state of decomposition is specially active. The presence, therefore, of developing fungi and bacteria must be looked on as active factors in causing calculi.

In looking, therefore, for the immediate causes of calculi we must consider especially all those conditions that determine the presence of albumin, blood, and excess of mucus, pus, etc., in the urine. Thus diseases of distant organs leading to albuminuria, diseases of the kidneys and urinary passages causing the escape of blood or the formation of mucus or pus, become direct causes of calculi. Foreign bodies of all kinds in the bladder or kidney have long been known as determining causes of calculi and as forming the central nucleus. This is now explained by the fact that these bodies are likely to carry bacteria into the passages and thus induce inflammation and decomposition, and they are further likely to irritate the mucous membrane and become enveloped in a coating of mucus, pus, and perhaps blood.

CLASSIFICATION OF URINARY CALCULI

These have been named according to the place where they are found—renal (kidney), ureteric (ureter), vesical (bladder), urethral (urethra), and preputial (sheath, or prepuce). They have been otherwise named according to their most abundant chemical constituent—calcium carbonate, calcium oxalate, and calcium phosphate calculi. The stones formed of carbonates or phosphates are usually smooth on the surface, though they may be molded into the shape of the cavity in which they have been formed; thus those in the pelvis of the kidney may have two or three short branchlike prolongations, whereas those in the bladder are round, oval, or slightly flattened upon each other. Calculi containing calcium oxalate, on the other hand, have a rough, open, crystalline surface, which has gained for them the name of mulberry calculi, from their morphological resemblance to that fruit. These are usually covered with more or less mucus or blood, produced by the irritation of the mucous membrane by their rough surfaces. The color of calculi varies from white to yellow and deep brown, the shades depending mainly on the amount of the coloring matter of blood, bile, or urine that they may contain.

RENAL CALCULI

These may consist of minute, almost microscopic, deposits in the uriniferous tubes in the substance of the kidney or of larger masses lodged in the pelvis. The larger calculi, sometimes weighing as much as 12 to 24 ounces, are molded in the pelvis of the kidney into a cylindroid mass with irregular, rounded swellings at intervals. Some

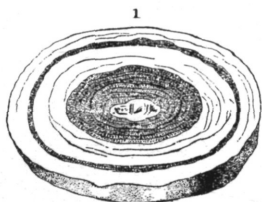
have a deep-brown, rough, crystalline surface of calcium oxalate, whereas others have a smooth, pearly white aspect from calcium carbonate. A smaller calculus, which has been called coralline, is also cylindroid, with a number of brown, rough, crystalline calcium oxalate branches and whitish depressions of carbonate. These vary in size from 15 grains to nearly 2 ounces. Less frequently masses of very hard, brownish-white, rounded, pealike calculi are found. These are smoother, but on the surface crystals of calcium oxalate may be detected with a lens. Some renal calculi are formed of more distinct layers, more loosely adherent to one another, and contain an excess of mucus, but no calcium oxalate. Finally, a loose aggregation of small masses forming a very friable calculus is found within the limits of the pelvis of the kidney. This, too, is in the main calcium carbonate (84 to 88 percent) without oxalate.

Symptoms of renal calculi are violent, colicky pains, appearing suddenly, often in connection with exhausting work and in certain cases disappearing with equal suddenness. The nature of the colic becomes more manifest if it is associated with stiffness of the back and hind legs, frequent passage of urine, and, above all, the passage of gravel with the urine, especially at the time of the access of relief. The passage of blood and pus in the urine is equally significant. If the irritation of the kidney goes on to active inflammation, the symptoms of nephritis are added.

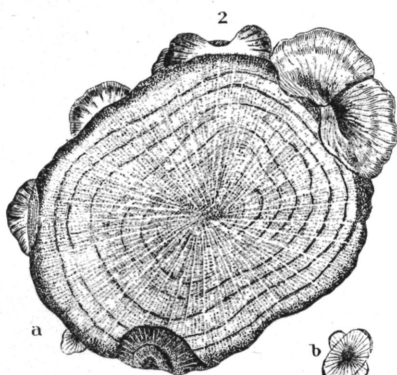
URETERIC CALCULI

These are so called because they are found in the passage leading from the kidney to the bladder. They are simply small, renal calculi that have escaped from the pelvis of the kidney and have become arrested in the ureter. Under suitable circumstances the obstruction may be felt through the walls of the rectum by an experienced diagnostician. These calculi give rise to symptoms almost identical with those of renal calculi, with this difference, that the colicky pains, caused by the obstruction of the ureter by the impacted calculus, are more violent, and if the calculus passes on into the bladder the relief is instantaneous and complete. If the ureter is completely blocked for a time, the retained urine may give rise to destructive inflammation in the kidney, which may end in the entire absorption of that organ, leaving only a fibrous capsule containing a urinous fluid. If both the ureters are similarly blocked, the animal will die of uremic poisoning.

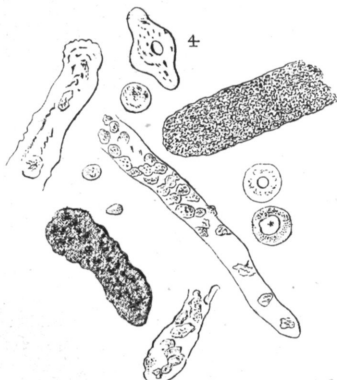
Treatment of renal and ureteric calculi.—Treatment is unsatisfactory, as only the small calculi can pass through the ureters and escape into the bladder. Passage of the calculi may be favored by agents that will relax the walls of the ureters by counteracting their spasm and even lessening their tone, and by a liberal use of water and watery fluids to increase the urine and the pressure on the calculus



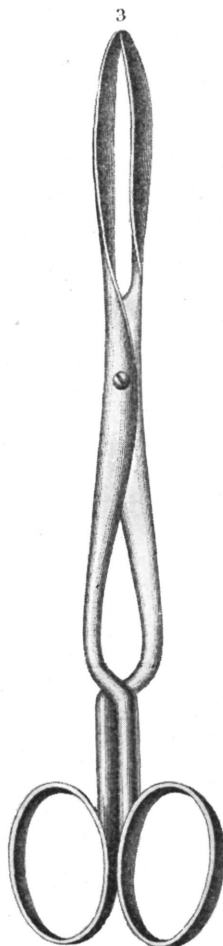
Phosphatic calculus, uric acid nucleus.



Calculus of oxalate of lime.



Renal casts. Some deprived of epithelium. Two are deeper colored from the presence of urate of soda.



Straight forceps used in removing calculi.

CALCULI AND INSTRUMENT FOR REMOVAL.

from behind. Drugs are sometimes given that relax the spasmodic grip of the ureter about the obstruction. To the same end warm fomentations may be applied across the loins and kept up persistently until relief is obtained. These act not only by soothing and relieving the spasm and inflammation, but also by favoring the freer secretion of a more watery urine and thus tending to carry off the smaller calculi. To accomplish this object further, give cool water freely, and let the feed be only such as contains a large proportion of liquid. The animal should receive as small a quantity of salts as possible. Bran especially should not be allowed and if any grains are fed they should be given sparingly.

If the acute stage has passed and the presence of the calculus is manifested only by the frequent passage of urine with gritty particles, by stiffness of the loins and hind legs, and by tenderness to pressure, the most promising resort is a long run at pasture where the grasses are fresh and succulent. The long-continued secretion of a watery urine will sometimes cause the breaking down of a calculus, as the absorbing of the less dense fluid by the organic, spongelike framework of the calculus causes it to swell and thus lessens its cohesion. The same end is sought by the long-continued use of alkalies (potassium carbonate), and of dilute acids (muriatic), each acting in a different way to alter the density and cohesion of the stone. Only exceptionally, however, is any one of these methods entirely satisfactory. If inflammation of the kidneys develops, this requires treatment.

STONE IN THE BLADDER (VESICAL CALCULUS, OR CYSTIC CALCULUS)

These may be of any size to over a pound in weight. One variety is rough and crystalline and has a yellowish-white or deep-brown color. These contain about 87 percent calcium carbonate, the remainder being magnesium carbonate, calcium oxalate, and organic matter. The phosphatic calculi are smooth, white, and formed of thin, concentric layers of great hardness extending from the nucleus outward. Besides calcium phosphate, they contain calcium and magnesium carbonates and organic matter. In some cases the bladder contains and may be even distended by a soft, pultaceous mass made up of minute, round granules of calcium and magnesium carbonates. This, when removed and dried, makes a firm, white, and stony mass. Sometimes this magma is condensed into a solid mass in the bladder by reason of the binding action of the mucus and other organic matter, and then forms a conglomerate stone of nearly uniform consistence and without stratification.

Symptoms.—The symptoms of stone in the bladder are more obvious than those of renal calculus. The rough, mulberry calculi especially lead to irritation of the mucous membrane and to frequent passing of

urine in small quantities, often mingled with mucus or blood or containing minute, gritty particles. At times the flow is suddenly arrested, though the animal continues to strain and the bladder is not quite emptied. In the smooth, phosphatic variety the irritation is much less marked and may even be altogether absent. With the pultaceous deposit in the bladder there is incontinence of urine, which dribbles continually and keeps the hair on the inner side of the thighs matted with soft magma. In most cases, the calculus may be felt by the examination of the bladder with the oiled hand in the rectum. The pear-shaped outline of the bladder can be felt beneath, and within it the solid, oval body. It is most easily recognized if the organ is half full of liquid, as then it is not grasped by the contracting walls of the bladder but may be made to move from place to place in the liquid. If a pultaceous mass is present it has a soft, doughy feeling, and when pressed an indentation is left.

In the mare the hard stone may be touched by the finger introduced through the short urethra.

Treatment.—The treatment of stone in the bladder consists in the removal of the offending body; in the mare this is easily effected with the lithotomy forceps. These are sterilized and lubricated and carried forward along the floor of the passage of the vulva to the orifice of the urethra in the median line. Through this the forceps are gradually pushed with gentle, oscillating movement until they enter the bladder and strike against the hard surface of the stone. The stone is then grasped between the blades, care being taken to include no loose fold of the mucous membrane, and it is gradually withdrawn with the same gentle, oscillating motions as before or carefully crushed within the bladder. Facility and safety in seizing the stone are greatly favored by having the bladder half full of liquid, and if necessary one oiled hand may be introduced into the rectum or vagina to assist. After crushing of the stone, if this is possible, the small pieces are flushed out by repeated irrigation of the bladder with an antiseptic solution. The same is usually introduced into the bladder after removal of an entire stone of considerable size, to allay the resulting inflammation.

The removal of the stone in the male is a much more difficult proceeding. In order to reach the calculus, it is necessary to cut into the urethra just beneath the anus and then introduce the lithotomy forceps from this forward into the bladder, as in the mare. It may be necessary to distend the urethra with tepid boiled water or other fluid or to insert a sound or catheter to furnish a guide on which the incision may be made. In the case of a large stone, it may be necessary to enlarge the passage by cutting in a direction upward and outward with a probe-pointed knife, the back of which is slid along in the groove of a director until it enters the bladder.

The horse may be operated on in the standing position, after the injection of an anesthetic into the spinal canal or over the site of the operation, the animal being simply pressed against the wall by a pole passed from before backward along the other side of the body. The tepid water is injected into the end of the penis until it is felt to fluctuate under the pressure of the finger, in the median line over the bone just beneath the anus. The incision is then made into the center of the fluctuating canal, from above downward. When a sound or catheter is used as a guide, it is inserted through the penis until it can be felt through the skin at the point where the incision is to be made beneath the anus. The skin is then made tense by the thumb and fingers of the left hand pressing on the two sides of the sound, while the right hand, armed with a scalpel, cuts downward onto the catheter. This vertical incision into the canal is so made as to avoid wounding any important blood vessel.

If the stone is too large to be extracted through the urethra, it may be broken down with the lithotrite and extracted piecemeal with the forceps. The lithotrite is an instrument composed of a straight stem bent for an inch or more to one side at its free end to form an obtuse angle, and having on the same side a sliding bar moving in a groove in the stem and operated by a screw so that the stone may be seized between the two blades at its free extremity and crushed again and again into pieces small enough to extract. Extra care is required to avoid injury to the urethra in the extraction of the angular fragments, and the gravel or powder that cannot be removed in this way must be washed out.

When a pultaceous magma of calcium carbonate accumulates in the bladder it may be washed out by injecting sterile water or mild antiseptic solutions through a catheter by means of a force pump or a funnel, shaking it with the hand introduced through the rectum and allowing the muddy liquid to flow out through the tube. This is repeated until the bladder is empty and the water comes away clear. A catheter with a double tube is sometimes used, the injection passing in through the one tube and escaping through the other.

To prevent the formation of a new deposit, any fault in feeding (dry grain and hay with privation of water, excess of beans, peas, wheat bran, etc.) and disorders of stomach, liver, and lungs must be corrected. An abundance of soft drinking water should be given and the animal encouraged to drink by giving a handful of salt daily. Laxative feed consisting largely of grass, roots, apples, pumpkins, or ensilage should be allowed. Chemicals intended to promote the solution of the deposits may be given.

URETHRAL CALCULUS (STONE IN THE URETHRA)

This is less frequent in horses than in cattle and sheep, owing to the larger size of the urethra in the horse and the absence of the S-shaped curve and vermiform appendage. The calculi arrested in the urethra are never formed there but consist of cystic calculi that have been small enough to pass through the neck of the bladder but are too large to pass through the whole length of the urethra and escape. Such calculi, therefore, are primarily formed either in the bladder or kidney and have the chemical composition of the other calculi found in those organs. They may be arrested at any point of the urethra, from the neck of the bladder back to the bend of the tube beneath the anus, and from that point down to the extremity of the penis. They have been found frequently in the papilla on the extreme end of the penis and immediately behind this.

Symptoms.—The symptoms may be violent straining to urinate, but without any discharge or with the escape of water in drops only. Colic may develop, or there may be only uneasiness with repeated elevation of the tail and muscular contractions of the urethra, the latter visible below the anus. Examination of the end of the penis may detect the swelling of the papilla or the urethra behind it and the presence of a hard mass in the center. A probe inserted into the urethra will strike against the calculus. If the stone has been arrested higher up, its position may be detected as a small, hard, sensitive knot on the line of the urethra, in the median line of the lower surface of the penis, or on the floor of the pelvis in the median line from the neck of the bladder back to the bend of the urethra beneath the anus. In any case the urethra between the neck of the bladder and the point of obstruction is likely to be filled with fluid and to feel like a distended tube, fluctuating on pressure.

Treatment.—This may begin by an attempt to extract the calculi by manipulation of the papilla on the end of the penis. This failing, the calculus may be seized with a pair of fine-pointed forceps and withdrawn from the urethra; or, if necessary, a probe-pointed knife may be inserted and the urethra slightly dilated or even laid open, and the stone removed. If the stone has been arrested higher up it may be pushed back into the bladder with a sound or catheter, or it may be extracted by a direct incision through the walls of the urethra and down upon the nodule. If in the free (protractile) portion of the penis, that organ may be withdrawn from its sheath until the nodule is exposed and can be incised. If behind the scrotum, the incision must be made in the median line between the thighs and directly over the nodule, the skin having been rendered tense by the fingers and thumb of the left hand. If the stone has been arrested in the intrapelvic portion of the urethra, the incision must be made beneath the anus and the calculus

extracted with forceps, as in stone in the bladder. The wound in the urethra is sutured and with good care usually heals slowly but satisfactorily.

PREPUTIAL CALCULI (CALCULI IN THE SHEATH, OR BILOCULAR CAVITY)

These are concretions in the sheath, though the term has been also applied to the nodule of sebaceous matter that accumulates in the blind pouches (bilocular cavity) by the sides of the papilla on the end of the penis. Within the sheath the concretion may be a soft, cheese-like sebaceous matter or a genuine calculus of calcium carbonate, oxalate, phosphate, and sulfate, magnesium carbonate, and organic matter. These are easily removed with the fingers, after which the sheath should be washed out with castile soap and warm water and smeared with olive oil or antiseptic mineral oil.

Diseases of the Genital Organs

By JAMES LAW, F. R. C. V. S.

[Revised by MAURICE S. SHAHAN, D. V. M.]

GENERAL CONSIDERATIONS IN HORSE BREEDING

The successful raising of horses is in general a more exacting procedure than the raising of other farm animals. The breeder's success, whether he be a farmer with only a few mares, or one whose chief activity is the breeding and sale of horses, is determined by his ability not only to select the animals wisely for mating but also to keep them in the best condition possible. A foal can develop to no greater extent than is inherently possible nor will it reach its greatest possibilities without good care.

The mare should be of good type, free from gross defects or disease that might be transmitted to her offspring, and at least 2 years of age and in good condition when bred. Mares infected with disease may conceive, but abortion or the birth of weak or dead foals frequently results when such animals are bred. Then, too, they may infect the stallion, and cause the destruction of his breeding power or at least make him a source of infection for other mares. Whenever possible, the stallion particularly should be a purebred, free from communicable disease, sound, in good condition, of suitable type, and preferably have a record of siring good offspring. The more valuable the mare or stallion, the more particular should one be with regard to the animal with which it is mated. There is little satisfaction or profit in propagating inferior types of animals.

All breeding animals thrive best if, in addition to proper feeding and other good care, they get regular exercise, whether it be at farm work, under the saddle, or in pasture. The amount of work that a mare in foal does or the exercise that she is given should be gradually diminished as foaling time approaches so that during the last few weeks of pregnancy, she will do only light work or will have a paddock to herself. She should not be allowed to become too fat, and just before foaling her ration should be particularly light and gently laxative.

For foaling, a maternity stall is very desirable. It should be clean and freshly bedded in preparation for the forthcoming foaling. The mare will usually do better if placed for several nights in the stall to accommodate herself to the new surroundings. Some mares, however,

will be unduly fretful if removed from their regular stall and stable mates and may, therefore, be allowed to foal in the more congenial surroundings, if these are kept clean and are otherwise adequate.

As foaling time approaches, the udder and external genital organs fill out and finally a laxness of the ligaments of the croup may be evident. The mare should then be watched and before straining becomes advanced, her tail may be bandaged with sterile gauze and the hindquarters may be washed with warm water and castile soap or with a warm, mild, antiseptic solution. If all is well, the mare needs no other assistance. The birth of the foal should be accomplished quickly, few foals being born alive if presentation is delayed more than a quarter of an hour after labor becomes well established. If no part of the foal becomes evident within that time or if the mare appears to be having trouble in expelling it, it then becomes important to obtain prompt delivery of the probably dead fetus.

Obstetrics, particularly in the mare, is essentially a professional task and there should be no delay in calling the veterinarian. In the normally delivered foal there is no advantage or necessity in tying the stump of the umbilical cord, but it may well be immersed in a receptacle containing tincture of iodine or dusted with powdered boric acid to prevent the entrance of infection. The foal should get some of the colostrum, or fore milk, from the dam's udder as soon as possible and assistance toward that end may be desirable.

The mare should be kept on a light, laxative diet for a few days until she has recovered, after which both she and the colt may well be placed in a clean, sunny paddock by themselves. The first 24 to 72 hours constitute a critical time for both mare and foal. If the foal shows any signs of constipation it should receive enemas of warm, soapy water or warm water with a little glycerin added and may be given 1 or 2 ounces of castor oil. The placenta (afterbirth) should be expelled promptly after the birth of the foal. If it is not, a veterinarian should see the mare as she may develop metritis (inflammation of the womb) or laminitis. During the first 10 days any material indispositions, such as rise in temperature, going off feed, stiffness, or straining in either mare or foal, are indicative of illness that may become serious if not promptly attended to.

The mare may come in heat in 3 to 12 days after foaling, but she should not be bred until there is an absence of a discharge from the genital organs that may indicate the presence of infection. Formerly, horse breeders commonly believed service on the ninth day to be more likely to result in impregnation than service at a later date, but this has been found to be not wholly true, and breeding may well be delayed till the second heat period after foaling in most cases. During the first few weeks after parturition the foal should not be permitted

to nurse the mare when she is hot and sweating or when she is sick from any cause as it may induce a severe scouring in the foal.

As the foal grows older, it is a common practice to permit it to attend the mare at work. It may then be encouraged to eat crushed oats or other grain placed in a creep into which older horses cannot get. This practice lessens the difficulty of weaning, which is begun at 4 to 6 months of age, depending on circumstances.

In the case of the male foal, unless it is a purebred of good quality, it should be castrated before it propagates its kind, whether by the owner's design or accidental mating. Draft fillies are usually bred at 2 years of age, whereas the lighter breeds are commonly held 1 year longer.

CONGESTION AND INFLAMMATION OF THE TESTICLES (ORCHITIS)

Apparently the most common cause of this condition in stallions is infection, probably contracted at the time of service from mares suffering from infection with various bacteria in the vagina or other parts of the genital tract. A degenerative type of orchitis sometimes develops, possibly as a result of navel infection at birth or infection acquired during the nursing period. Among the other causes of orchitis are blows, or kicks, and penetrating wounds implicating the testicles, abrasions of the scrotum by a chain or rope passing inside the thigh, contusions and frictions on the gland under rapid paces or heavy draft, compression of the blood vessels of the spermatic cord by the inguinal ring under the same circumstances, and, finally, sympathetic disturbance in cases of disease of the kidneys, bladder, or urethra. Stimulants of the genital functions, such as rue, savin, tansy, cantharides, and damiana, may also be accessory causes of congestion and inflammation. Finally, certain specific diseases, such as dourine, glanders, and tuberculosis, localized in the testicles, will cause inflammation.

Symptoms.—Aside from actual wounds of the parts or degenerated testicles, the symptoms of orchitis are swelling, heat, and tenderness of the testicles, straddling with the hind legs alike in standing and walking, stiffness and dragging of the hind legs or of the leg on the affected side, arching of the loins, abdominal pain, manifested by glancing back at the flank, more or less fever, elevated body temperature, accelerated pulse and breathing, lack of appetite, and dullness. In bad cases the scanty urine may be reddish and the swelling may extend to the skin and envelopes of the testicle, which may become thickened and doughy, pitting on pressure. The swelling may be so much greater in the convoluted excretory duct along the upper border of the testicle as to suggest the presence of a supernumerary testicle. Even in the more violent attacks the intense suffering abates somewhat

on the second or third day. If it lasts longer, it is likely to give rise to the formation of pus. In exceptional cases the testicle is affected with gangrene and is thereby destroyed. Improvement may go on slowly to complete recovery, or the malady may subside into a subacute and chronic form with induration. Pus may be recognized by the presence of a soft spot, where pressure with two fingers will detect fluctuation from one to the other. When there is liquid exudation into the scrotum, or sac, fluctuation may also be felt, but the liquid is found to be around the testicle and can be pressed up into the abdomen through the inguinal canal. When abscess occurs in the cord, the pus may escape into the scrotal sac and cavity of the abdomen and pyemia may follow. The degenerative form of orchitis ordinarily passes unobserved up to breeding age, when the animal is found to be infertile. The animal has normal sexual desire and will mount the mare but no spermatazoa are ejaculated. On examination, one or both of the testicles are found to be of less than normal size and may be flabby in texture, much like these organs in a cryptorchid or ridgeling.

Treatment.—The stallion should be removed immediately from the stud to quiet surroundings. His diet should be restricted to laxative feeds, and rest or only moderate exercise should be allowed. Some cases will recover with this treatment only. In the early stages an ice or cold-water pack held over the scrotum by a suspensory band may be beneficial. Or an astringent lotion in cotton held in place by the suspensory bandage may be used. If but one testicle is involved, the veterinarian may advise its removal to prevent spread of infection to the other gland. Atrophied glands resulting from degenerative orchitis are best removed, as there is little chance for restoration of normal function. In some cases it may be necessary to draw off accumulated inflammatory fluid with a sterile needle. Others in which abscesses form may require incision, drainage, and antiseptic treatment. If gangrene develops, castration is usually resorted to. Internal medication is desirable in some cases.

When the stallion has apparently recovered, he should be given a rest from breeding before being returned to stud service.

SARCOCELE

This is an enlarged and indurated condition of the testicle, that may result from any chronic inflammation, though it is often associated with a specific disease, like glanders. In this condition, restoration of the gland to health is very improbable. The diseased testicle is enlarged, firm, nonelastic, and comparatively insensible. The skin of the scrotum is tense, and it may be edematous (pitting on pressure), as are the deeper envelopes and spermatic cord. If liquid is present in the sac, the symptoms are masked somewhat.

As it increases it causes awkward, straddling, dragging movement of the hind legs, or lameness on the affected side. The spermatic cord often increases in size at the same time with the testicle, and the inguinal ring being thereby stretched and enlarged, a portion of intestine may escape into the sac, complicating the disease with hernia.

The only rational and effective treatment in most cases is castration, but when the disease is specific (glanders, tuberculosis), even this may not be desirable.

HYDROCELE (DROPSY WITHIN THE SCROTUM)

This may be merely an accompaniment of dropsy of the abdomen, the cavity of which is continuous with that of the scrotum in horses. It may be the result, however, of local disease in the testicle, spermatic cord, or walls of the sac.

When it develops in castrated animals, particularly mules, it is commonly called water bag or water seed. This is generally caused by failure to remove enough of the membrane covering the testicle at the time of castration.

Symptoms.—The symptoms are enlargement of the scrotum and fluctuation under the fingers, the testicle being recognized as floating in water. By pressure the liquid is forced, in a slow stream and with a perceptible thrill, into the abdomen. Sometimes the cord or the scrotum is thickened and pits on pressure.

Swelling of the scrotum may be due to a hernia in which intestines may be in the scrotum, as well as to orchitis or hydrocele.

Treatment.—This may be the same as for ascites, yet when the effusion has resulted from inflammation of the testicle or cord, astringent applications may be applied to these. Then, if the liquid is not resorbed, it may be drawn off through the needle of a hypodermic syringe that has been sterilized. In geldings it is best to dissect out the sacs.

VARICOCELE

This is an enlargement of the venous network of the spermatic cord and gives rise to general thickening of the cord from the testicle up to the inguinal ring. Astringent dressings may be tried as in hydrocele, and, this failing, castration is usually resorted to.

ABNORMAL NUMBER OF TESTICLES

Sometimes one or both testicles are wanting; in most cases of this kind, however, they are merely partially developed and retained in the inguinal canal or abdomen (cryptorchid). In rare cases there may be a third testicle, the animal becoming to this extent a so-called

monster. Teeth, hair, and other indications of a second fetus have likewise been found in the testicle or scrotum.

DEGENERATION OF THE TESTICLES

The testicles may become the seat of fibrous, calcareous, fatty, cartilaginous, or cystic degeneration, for all of which the appropriate treatment is castration. They also become the seat of cancer, glanders, or tuberculosis, and castration is requisite, though with less hope of arresting the disease. Finally, they may become infested with cystic tapeworms or the agamic stage of a strongyle (*Strongylus edentatus*).

TUMORS OF THE PENIS

Warts, or papillomata, may occur on the penis as well as on the membranes of the sheath. They may be twisted off below their base or cut off with scissors or by a tightened silk thread, after which the wound may be cauterized with silver nitrate.

Pigmented tumors are not uncommonly seen on the penis or in the sheath of horses, mostly aged white, gray, or roan-colored animals. Many of these are malignant, that is, they may spread to other parts of the body and cause death.

Geldings particularly, and more rarely stallions, may have cancers on the penis. These may become great cauliflowerlike growths that are foul smelling and may interfere with urination or spread to such an extent as to cause death. They are removed surgically, the penis being amputated at a point above the growth. The control of hemorrhage and a satisfactory restoration of the urethral opening are important considerations in this operation.

EXTRAVASATION OF BLOOD IN THE PENIS

As the result of kicks, blows, or of forcible striking of the penis on the thighs of the mare, that it has failed to enter, the penis may become the seat of effusion of blood from one or more ruptured blood vessels. This gives rise to a more or less extensive swelling, followed by some heat and inflammation, and on recovery a serious curving of the organ. The treatment in the early stages may be the application of cold packs or lotions, or other astringents, to limit the effusion and favor absorption. The penis should be suspended in a sling.

PARALYSIS OF THE PENIS

This results from blows and other injuries and also in some cases from too frequent and exhausting service. The penis hangs from the sheath, flaccid, pendulous, and often cold. The passage of urine

occurs with lessened force and especially without the final jets. In cases of local injury the inflammation is first to be allayed by astringent and emollient lotions. The system should be invigorated by nourishing diet, and systemic tonics may be given.

SELF-ABUSE (MASTURBATION)

Some stallions acquire this vicious habit, stimulating the sexual organs to the discharge of semen by rubbing the penis against the belly or between the forelegs. The only effective remedy is a mechanical one, the fixing of a net or shield in such a fashion as to prevent the extension of the penis or so prick the organ as to compel the animal to desist through pain. A ring that can be readily removed at breeding time prevents the habit through restriction of erection of the organ. However, before the habit has become fixed, regular exercise or moderate work, together with such feeding and care as will promote the general health of the animal, will often remedy the tendency.

DOURINE

This disease is discussed in the chapter on Infectious Diseases, p. 531.

CASTRATION

CASTRATION OF STALLIONS

Castration is usually done at 1 year of age but may be accomplished at a few weeks of age at the probable expense of an imperfect development of the fore parts. The simplicity and safety of the operation are greatest in the young, but animals of any age, in good condition, may be castrated by the experienced operator. The delay till 2, 3, or 4 years of age may result in a better development and carriage of the fore parts. Mule colts are customarily "cut" at an earlier age than horse colts. Generally speaking, any inferior animal should be castrated as early as possible to prevent breeding.

The essential part of castration is the safe removal or destruction of the testicle and the arrest or prevention of bleeding from the spermatic artery in the anterior part of the cord. There are many methods of accomplishing this; only one, castration by means of the emasculator, is discussed here. Some veterinarians prefer to perform the operation with the horse in a standing position, but usually the animal is cast by means of rope or a special harness for the purpose. The actual technic followed is varied by individual operators and the circumstances in each instance.

After the animal has been thrown on his side, and the upper hind foot drawn up, usually with the leg flexed, the exposed scrotum, penis, and sheath are washed with soap and water or an antiseptic solution,

any concretion of sebum being carefully removed from the bilocular cavity in the end of the penis. The spermatic cord, just above the testicle, is now seized in one hand to render the skin tense over the stone, and the other hand makes an incision with the knife, from before backward, about three-fourths of an inch from and parallel to the median line between the thighs, deep enough to expose the testicle and long enough to allow that organ to start out through the skin. At the moment of making this incision the hand must grasp the cord very firmly, in animals not anesthetized, otherwise the sudden retraction of the testicle by the cremaster muscle may draw it out of the hand and upward into the inguinal canal and even into the abdomen. In a few seconds, when the struggle and retraction have ceased, the knife is inserted through the cord, between its anterior and posterior portions, and the latter, the one that the muscle retracts, is cut completely through. The testicle will now hang limp, and there is no longer any tendency to retraction. It is pulled out at a right angle to the body and an instrument known as an emasculator applied around the still attached portion of the cord, close up to the skin.

The emasculator is a specially constructed instrument provided with long handles that afford leverage, and two jaws that, when applied to the cord, crush and cut the cord, freeing the testicle. The crushing and cutting are accomplished in one operation, after which the instrument is removed. Animals so castrated have no clamps or ligatures applied.

A few hours after the operation most veterinarians prefer that the animals be turned into a clean paddock or pasture where green grass is available and the animal can exercise moderately. In all but exceptional cases, this is probably preferable to keeping the animal in a corral or in the stable where greater opportunity for contracting infection may exist. Some operators use antiseptic oils or ointment after operating, to prevent the sticking of the margins of the wound together, thereby assuring drainage, and to prevent attacks by flies, particularly screwworm flies.

In some localities where the latter are prevalent, castration is done at a season of the year when the flies are absent or inactive, or forceps designed to crush the cord without incising the skin are employed. Following proper severance of the cord, the testicle shrinks to a small mass of nonfunctioning tissue. Such instruments have been proved to be very successful, when properly constructed and used on young animals by experienced operators. Whatever its apparent simplicity, castration by any means should be considered as a technical operation to be performed by a veterinarian whenever possible.

The young horse suffers less from castration than the old one and rarely dies. Good health in the animal is important. Castration

should never be attempted during the prevalence of strangles, influenza, catarrhal fever, contagious pleurisy, bronchitis, pneumonia, purpura hemorrhagica, or other specific disease, nor on animals that have been kept in close, ill-ventilated, filthy buildings. Warm weather is to be preferred to cold, but fly time should be avoided or the flies kept away by the application to the wound of a repellent.

CASTRATION OF CRYPTORCHIDS (RIDGELINGS)

This consists in the removal of a testicle or testicles that have failed to descend into the scrotum but have been detained in the inguinal canal or inside the abdomen. Animals having one or both testicles retained within the abdomen, although retaining their sexual desire, are usually sterile. Their troublesome tendencies, together with occasional, extreme viciousness and the likelihood of the condition being transmitted to colts, make castration desirable, though the defect might in some cases be remedied by injecting certain gland extracts.

The manipulation requires an accurate anatomical knowledge of the parts, and special skill, experience, and manual dexterity, and cannot be made clear to the nonprofessional reader in a short description. It consists, however, in the discovery and removal of the abnormally situated gland by exploring through the natural channel (the inguinal canal), or, in case it is not there, through the inguinal ring or through an artificial opening made in front and above that channel between the abdominal muscles and the strong fascia on the inner side of the thigh (Poupart's ligament). The operation is usually carried out under partial or complete anesthesia. The skin of the horse and the hands of the operator should be scrupulously clean and the instruments used should be sterilized to lessen the possibilities of infection. In most cases it is necessary to sew up the external wound and keep the animal quiet, for a while at least, to favor healing of the wound. A packing of sterile gauze is often inserted in the inguinal canal after the operation. This, of course, must be subsequently removed.

CONDITIONS FOLLOWING CASTRATION

Circumstances beyond the control of the operator may bring about conditions that should be promptly handled, whenever possible, by the veterinarian.

Pain after castration.—Some horses are in pain and very restless for several hours after castration, and this may extend to cramps of the bowels and violent colic. This is best kept in check by carefully rubbing the patient dry when he rises from the operation and then leading him in hand for some time. If the pain still persists a sedative may be given.

Bleeding after castration.—Some bleeding from the wound in the scrotum and from the little artery in the posterior portion of the sper-

matic cord always occurs and in warm weather may appear to be quite free. However, it rarely lasts more than 15 minutes. If it persists it may be checked by dashing cold water against the part.

Dangerous bleeding from the spermatic artery in the anterior part of the cord rarely occurs when due precautions have been taken to prevent it. When it does occur the stump of the cord should be sought for and the artery closed with sterile artery forceps or with a sterile ligature. If the stump cannot be found, pledgets of cotton wet with tincture of ferric chloride or other styptic agent may be stuffed into the canal to favor the formation of clot and the closure of the artery. However, such treatment is not generally desirable, except as a last resort.

Strangulated spermatic cord.—If in castration the cord is left too long, so as to hang out of the wound, the skin wound in contracting may entrap it, preventing the free return of blood and causing a steadily advancing swelling. In addition, the cord is inclined to adhere to the lips of the wound in the skin and is thereby stimulated to more rapid swelling. The animal walks stiffly, with a straddling gait, loses appetite, and has a rapid pulse and high fever. Examination of the wound discloses the partial closure of the skin wound and the protrusion, from its lips, of the end of the cord, red, tense, and as large as a hazelnut and often larger. If there is no material swelling and little protrusion, the wound may be enlarged with the knife and the end of the cord broken loose from any connection with the skin and pushed up inside. If the swelling is considerable, the mass must usually be removed.

Swelling of the sheath, penis, or abdomen.—Excessive swelling of the wound, sometimes involving the sheath, penis, and abdomen, is invariably caused by infection. It may be avoided to a great extent by aseptic or antiseptic precautions at the time of castration. If it develops through failure of cleanliness during the operation or as a result of subsequent infection from unclean surroundings, the wound should be reopened with sterile instruments or clean fingers and the cavity thoroughly irrigated with an antiseptic solution. If the swelling becomes extreme, hot packs of antiseptic solution may be applied, or the skin may be pricked to permit drainage of the fluid from the swelling. The scarifications or pricks should be regularly treated antiseptically until they heal.

Phymosis and paraphymosis.—In cases of swelling, as that just described, the penis may be imprisoned within the sheath (phymosis) or protruded and swollen so that it cannot be retracted into it (paraphymosis). This is usually temporary, but in cases in which the swelling does not recede within 2 or 3 days or if it interferes with the

elimination of urine, packs saturated with warm water containing all the Epsom salts that will dissolve in it may be applied every few minutes for several hours. This may reduce the swelling so that the organ can be returned to the sheath. Otherwise, scarifying the skin of the prepuce may reduce the swelling. If the organ swells greatly a supporting bandage may be desirable.

Tumors of the spermatic cord (scirrhus cord).—Although ligatures are often desirable, particularly in the castration of older animals, to prevent hemorrhage, the presence of a nonabsorbable foreign material may cause a chronic irritation, as a result of which a progressive growth of scar tissue develops. A similar condition sometimes follows infections, particularly if the membranes covering the cord or the cord itself have been left too long when the testicle was removed. Absorbable catgut is preferable to linen or silk ligatures, and its use, together with particular cleanliness and thoroughness in operating, will prevent most cases of scirrhus cord. Early cases may be healed by the application of tincture of iodine every 2 days.

The growth at first may be small but it usually gradually increases, sometimes being neglected until it has reached a weight of 15 to 20 pounds. The earlier the condition is discovered, the less serious is the operation that must usually be performed to remove the growth. The operation is tedious and the control of hemorrhage is of great importance. The animal is usually anesthetized.

CASTRATION BY THE COVERED OPERATION

This is required only in case of hernia or protrusion of the bowels or omentum into the sac of the scrotum and consists in the reduction of the hernia and the application of clamps or sutures over the cord and inner walls of the inguinal canal, so that the walls of the latter become adherent above the clamps or sutures, the canal is obliterated, and further protrusion is hindered. For the description of this and of the operation for hernia for geldings, see remarks on hernia, page 66.

CASTRATION OF THE MARE (SPAYING)

Castration is a much more dangerous operation in the mare than in the females of other domesticated quadrupeds and is usually not resorted to except in animals that become unmanageable on the recurrence of heat and that will not breed or that are utterly unsuited to breeding. Formerly the operation was extensively practiced in Europe, the incision being made through the flank. By operating through the vagina the danger of infection in the wound is greatly lessened. The animal may be fixed in a stall, with a sling placed under the body and strong sedatives administered, or it may be anesthetized and thrown. The operation demands special profes-

sional knowledge and skill and should be undertaken only by a veterinarian. It consists essentially in making an opening through the wall of the vagina just behind the neck of the womb, then following with the hand each horn of the womb until the ovary on that side is reached and grasped between the jaws of the forceps and twisted or crushed off. It may be torn off by an ecraseur especially constructed for the purpose. The straining that follows the operation may be checked by sedatives and any risk of protrusion of the bowels may be obviated by applying a truss to prevent eversion of the womb. As a further deterrent to pressure of the abdominal contents against the vaginal wound the mare may be tied short and high for 24 to 48 hours, after which the truss may be removed and the animal allowed to lie down. Another important point is to give moderate quantities of bran mashes and other laxative diet only, for a fortnight, and to unload the rectum by copious injections of warm water in case of straining to defecate.

COITAL EXANTHEMA (GENITAL HORSEPOX; ERUPTIVE VENEREAL DISEASE)

This is a highly contagious affection of the genital organs, affecting both mares and stallions, which is spread chiefly through sexual intercourse. A similar disease is also seen in cattle but, as far as is known, the two species do not infect each other. Coital exnathema should not be confused with common horsepox, or variola, which is discussed under infectious diseases or with the more serious venereal disease, dourine.

The symptoms appear in a few days after intercourse with an infected animal. These consist in the appearance of small, yellowish-white, blisterlike lesions in the membranes lining the vulva in the mare and those of the sheath and penis in the male. The pustules later rupture and become confluent, resulting in ulceration with a yellowish membrane, the removal of which causes bleeding. The inflammation and suppuration cause a swelling of the parts and a purulent discharge. The infection commonly incites heat in the mare. The lesions usually heal without serious permanent injury, and there are small white spots where the skin of the vulva and adjacent tissues were ulcerated. These tend to disappear in 2 to 3 weeks.

Treatment.—In the early stages of the disease, treatment consists in the application to the affected parts of mild antiseptic solutions. However, in neglected cases, the condition may spread to infect the mouth of the womb or even the womb itself, when it becomes a much more serious matter. (See Inflammation of the Womb, p. 190). The spread of coital exanthema in a stable may be controlled by isolation of the affected animals, provision of separate attendants for the

healthy, and other general sanitary measures. The stallion should not be exposed to any infected mare and no mare should be bred by any stallion showing evidence of venereal disease. A veterinarian should be consulted.

STERILITY

Sterility may occur in the male or in the female. If the stallion is sterile, then all the mares put to him remain barren. If the fault is in the mare, she alone fails to conceive, whereas normal mares served by the same stallion get in foal.

In the stallion sterility may be due to the following causes: Imperfect development of the testicles, as in cases in which they are retained within the abdomen; inflammation of the testicles, resulting in induration; fatty degeneration of the testicles, caused by liberal feeding on starchy feed and insufficient exercise; fatty degeneration of the excretory ducts of the testicles; inflammation or ulceration of these ducts; inflammation or ulceration of the mucous membrane covering the penis; injuries to the penis from blows (often causing paralysis); warty growths on the end of the penis; tumors of other kinds (largely pigmentary), affecting the testicles or penis; nervous diseases that destroy the sexual desire or that control the muscles essential to the act of coition; azoturia with resulting weakness or paralysis of the muscles of the loins or the front of the thigh (above the stifle); ossification (ankylosis) of the joints of the back or loins, which render the animal unable to rear or mount; spavins, ringbones, or other painful affections of the hind legs, the pain of which in mounting, causes the animal suddenly to stop short in the act. In some of these there is real sterility in the sense of the nondevelopment or imperfect development of the male vivifying element (spermatozoa). In the other conditions the secretion may be imperfect in kind and quantity, but in addition copulation is prevented and it cannot reach and impregnate the ovum. The stallion that is excessively used for breeding purposes, sometimes without proper feed, exercise, and other care, is likely to ejaculate weak sperm cells that in only a few instances will fertilize the egg in the womb.

In the mare, barrenness may be due also to a variety of causes. In some studs the proportion of sterile mares has varied from 20 to 40 percent. The two most common causes of sterility in the mare are infection and glandular disturbances. In the case of infection, one of several specific micro-organisms may be the inciting agent or so-called mixed infections may occur. Acute or chronic infections of the vagina, the neck of the womb, the womb itself, the ovaries, or the tubes that convey the ova to the womb from the ovaries may temporarily or permanently prevent conception. Many such infections are believed to have their beginning at the time of foaling under

insanitary conditions. Mares may be made sterile by systemic disease, disease of the urinary organs, poor nutrition, overwork, or other seriously debilitating influences. Mares that are not bred before they are of advanced age are often infertile. Others in exceptionally fine condition may be temporarily sterile. Improperly functioning ovaries, either through direct disturbance of those glands or the influence of other interrelated glands such as the pituitary, thyroid, and adrenal, is a more or less common cause of failure to conceive. It was formerly believed that closure of the mouth of the womb as a result of spasm was a common cause of sterility. To remedy the condition a great variety of dilators and other appliances were used to "open" the neck of the womb before service. It is now thought that such procedures usually are not only unnecessary but also that they are injurious. If the neck of the womb is abnormally contracted during estrum (heat), it is usually so as a result of inflammation. For this reason, it is absolutely wrong for untrained persons to attempt to "open the womb" by any method. Abrupt, radical changes in climate may account for temporary barrenness. Both male and female hybrids are usually sterile. Infrequently hermaphrodites, animals having the organs of both sexes more or less completely developed, are seen; these are, of course, sterile. The presence of an imperforate hymen, a rare but not unknown condition in fillies, may prevent conception.

Treatment.—The treatment of most of these conditions is given in other parts of this book, so that it is necessary here only to name them as causes. Some, however, must be specially referred to in this section. Stallions with undescended testicles are beyond the reach of medicine and should be castrated and used for purposes other than breeding. Indurated testicles may sometimes be remedied in the early stages by persistent local and systemic treatment. At the same time the system may be invigorated by liberal feeding and judicious work. Fatty degeneration is best treated by a diet of high protein content (wheat bran, cottonseed meal, rape cake) and constant, well-regulated work or exercise. Excesses of starchy and fatty feeds (for instance, potatoes, wheat, corn) are to be especially avoided.

In the mare, as in the stallion, treatment depends on the nature of the underlying cause. Very fat mares that fail to conceive may have this defect only because of too rich or too abundant rations or lack of proper exercise. Even fatigue will act beneficially in some such cases, hence the practice of the Arab riding his mare to exhaustion just before service. On the other hand, a mare much weakened by disease, overwork, underfeeding, or poor care in general may scarcely be expected to reproduce as one in better condition. Gen-

erally speaking, if the mare or the stallion is not in prime condition, breeding should not be attempted. If, despite good care and conditioning, the mare does not get with foal, other causes should be sought. The recognition and treatment of diseases of the genital organs should be entrusted to a veterinarian since more harm than good may be done by improper treatments.

PREGNANCY

INDICATIONS OF PREGNANCY

As the mere fact of service by the stallion does not insure pregnancy, it is important that the result should be determined to save the mare from unnecessary and dangerous work or medication when actually in foal and to obviate wasteful and needless precautions when she is not.

The cessation and nonrecurrence of the symptoms of heat (horsing) are most significant, though not an infallible sign of conception. If the sexual excitement speedily subsides and the mare persistently refuses the stallion for a month, she is probably pregnant. In exceptional cases a mare, though pregnant, will accept a second or third service after weeks or months, and some mares will refuse the horse persistently, though conception has not taken place, and this in spite of warm weather, good condition of the mare, and liberal feeding. The recurrence of heat in the pregnant mare is most likely to take place in hot weather. If heat merely persists an undue length of time after service, or if it reappears shortly after, in warm weather and in a comparatively idle mare, on good feeding, it is less significant, whereas the persistent absence of heat under such conditions may be usually accepted as proof of conception.

An unwonted gentleness and docility on the part of a previously irritable or vicious mare, following service, is a common indication of pregnancy, the genital instinct, that caused the excitement having been satisfied.

An increase of fat, with softness and flabbiness of muscle, a loss of energy, indisposition for active work, a manifestation of laziness, and of fatigue early and easily induced, when preceded by service, also suggest conception.

Enlargement of the abdomen, especially in its lower third, with slight falling in beneath the loins and hollowness of the back are suggestive symptoms, though they may be entirely absent. Swelling and firmness of the udder, with the smoothing out of its wrinkles, are suggestive signs, even though they appear only at intervals during gestation. A steady increase in weight ($1\frac{1}{2}$ pounds daily) about the fourth or fifth month is an indication of pregnancy.

From the seventh or eighth month onward the foal may be felt by the hand (palm or knuckles) pressed against the abdomen in front of the left stifle. The sudden but not too violent push displaces the foal toward the opposite side of the womb, and as it floats back its hard body is felt to strike against the hand. If the pressure is maintained the movements of the live foal may be felt, especially in the morning and after a drink of cold water or during feeding. A drink of cold water often stimulates the fetus to movements that may be seen by the eye, but an excess of ice water may prove injurious, or even cause abortion. Cold water dashed on the belly has a similar effect on the fetus but may be provocative of abortion. Finally, the ear or stethoscope applied on the wall of the abdomen in front of the stifle may detect the beating of the fetal heart (125 a minute) and a blowing sound (the uterine sough), much less rapid and corresponding to the number of the pulse of the dam. It is heard most satisfactorily after the sixth or eighth month and in the absence of active rumbling of the bowels of the dam.

The veterinarian can usually diagnose pregnancy in the mare, after it has sufficiently progressed, by palpation of the ovaries and the womb through the walls of the rectum and by examination of the vagina and the neck of the womb through a speculum inserted into the vagina.

Also, there is available a test for pregnancy in the mare similar to that known first as the Aschheim-Zondek test as applied for the diagnosis of pregnancy in women. In general, the test consists in injecting rabbits, rats, or mice with blood serum or urine from the mare in which pregnancy is to be determined. The genital organs of the animals inoculated show, after a time, certain characteristic changes that are induced by the presence, in the inoculated material, of specific hormones—those substances derived from the internal secretions of certain glands and organs. These hormones are present in varying quantities at different times during pregnancy, and by this test pregnancy can be determined earlier than it is possible to detect it otherwise in most cases.

DURATION OF PREGNANCY

The duration of pregnancy in mares is usually about 11 months, though first pregnancies often last a year. Foals have lived when born at the three-hundredth day; some have lived when carried till the four-hundredth day. Knowledge of the expected foaling time is but one of the many advantages of accurate and complete breeding records. The breeder desirous of promoting and maintaining the health of his animals can assist his veterinarian by keeping such records.

HYGIENE OF THE PREGNANT MARE

The pregnant mare should not be overworked or fatigued, particularly under the saddle or on uneven ground. Yet exercise is beneficial

to both mother and fetus, and in the absence of moderate work the breeding mare should be kept in a lot where she can take exercise at will.

The feed should be liberal but not fattening—oats, bran, sound hay (including at least some from legumes), and other feeds rich in the principles that form muscle and bone being especially desirable. Oats, if they are of good quality, are among the best feeds for horses but often it is well to add other grains to the ration. Thus a good grade of corn may be included, but preferably not to exceed one-third to one-half of the grain ration, for mares especially. Barley, preferably ground or rolled, is fed in some localities. Wheat, except as bran, is generally undesirable. In some localities, or with some feeds, mineral supplements to the ration may be desirable. All feeds that tend to cause indigestion are to be avoided or fed with caution. From this standpoint the following feeds are objectionable: Rank, aqueous, rapidly growing grasses and other green feed, partly ripe rye grass, millet, vetches, peas, beans, or corn; and overripe, fibrous, innutritious hay or straw, especially if it is musty or moldy or infested with smut or ergot. Feed that tends to costiveness should be avoided. Water given often and at a temperature considerably above freezing tends to avoid the dangers of indigestion. Very cold or frozen feed also should be avoided. Severe surgical operations and medicines that act violently on the womb, bowels, or kidneys may cause abortion. Constipation when it occurs should be corrected, if possible, by bran mash, carrots, or beets, seconded by exercise, and if a medicinal laxative is required, olive oil or other equally bland agent is desirable.

The stall of the pregnant mare should not be so narrow as to cramp her when lying down or to entail violent effort in getting up, and it should not slope too much from the front backward, as this tends to throw the weight of the uterus back on the pelvis and endanger protrusions and even abortion.

Pregnant mares on pasture are best kept by themselves, and grain should be fed according to their condition. In no case should they be permitted contact with animals or premises known to be or suspected of being infected with disease, especially infectious equine abortion. Mares, especially on premises where infectious abortion is known to exist, should be under a veterinarian's supervision.

EXTRA-UTERINE GESTATION

It is rare in domestic animals to find the fetus developed elsewhere than in the womb. The exceptional forms are those in which the sperm of the male, making its way through the womb and Fallopian tubes, impregnates the ovum prior to its escape, and in which the now vitalized and growing ovum, by reason of its gradually increasing

size, becomes imprisoned and fails to escape into the womb. The arrest of the ovum may be in the substance of the ovary itself (ovarian pregnancy), in the Fallopian tube (tubal pregnancy), or when by its continuous enlargement it has ruptured its envelopes so that it escapes into the cavity of the abdomen, it may become attached to any part of the serous membrane and draw its nourishment directly from that (abdominal pregnancy). In all such cases there are an increase and enlargement of the capillary blood vessels at the point to which the embryo has attached itself so as to furnish the needful nutriment for the growing offspring.

All appreciable symptoms are absent, unless from the death of the fetus or its interference with normal functions, general disorder and indications of parturition supervene. If these occur later than the natural time for parturition, they are the more significant. There may be general malaise, loss of appetite, elevated temperature, accelerated pulse, with or without distinct labor pains. Examination through the walls of the rectum will reveal to the veterinarian the womb of the natural, unimpregnated size and shape and with both horns of one size. Further exploration may detect a resilient mass apart from the womb, in the interior of which may be felt the characteristic solid body of the fetus. If the latter is still alive and can be stimulated to move, the evidence is even better. In rare, selected cases, under proper conditions, it may be possible to relieve the mare of the fetus through laparotomy (cutting into the abdominal cavity). This operation requires special preparation of the mare and strictly aseptic technique, the description of which is beyond the province of this book. The fetus may die and be carried for years, its soft structures becoming absorbed so as to leave only the bones, or by pressure it may even form a fistulous opening through the abdominal walls and less frequently through the vagina or rectum. In either of the last two, the only course is to promote the expulsion of the foal and to treat the resulting cavity antiseptically.

In most cases when there is no spontaneous opening it is injudicious to interfere, as the danger from the retention of the fetus is less than that from septic inflammation in the large fetal sac when that has been opened.

MOLE (UNNATURAL DEAD EMBRYO)

This is evidently a product of conception, in which the impregnated ovum in its embryonic sac has failed to develop naturally (possibly because of infection or hereditary defect), but becomes a chaotic mass of skin, hair, bones, muscles, etc., attached to the inner surface of the womb by an umbilical cord, which is often shriveled and wasted. It rarely accompanies a well-developed fetus, so that the mole may be looked upon as a twin that has undergone arrested

development with deterioration of form. It may be expelled by the ordinary process of parturition with the normally developed offspring. Otherwise the mass, which sometimes consists of little more than a water-filled sac, may become shriveled and dried to form a so-called desiccated cystic mole. If this remains free of bacteria it may lie in the uterus for years without causing any trouble except sterility. But if pus-forming germs contaminate the mass, it becomes a semi-fluid, mushy material that usually induces a vigorous attempt on the part of the womb to expel it. This should usually be assisted by manual removal of the degenerated tissue and mild antiseptic treatment of the womb.

DROPSY OF THE FETAL MEMBRANES

The embryo, which results from the successful fertilization of the ovum of the mare by the sperm cell from the stallion, early develops a membranous sac about it. This, through its attachment to the wall of the womb and the umbilical cord, supplies the developing body of the fetus with blood from the mother. The membrane, technically referred to as the placenta and more commonly as the afterbirth, consists of three layers—the chorion, which is closely attached to the inside of the womb; the allantois or middle membrane; and the innermost layer, the amnion, which sometimes envelops the delivered foal. The struggles of the young usually soon free it from the enveloping membrane; if not, it should be removed by the attendant. Inside the sac of the amnion and the next layer of the placenta, the allantois, there is a cushion of fluid, which, with the membranes, at the time of parturition forms a wedge, gradually dilating the neck of the womb, thus assisting delivery. Normally this fluid varies from 10 to 20 quarts. A marked increase in this fluid to as much as 25 to 50 gallons is sometimes observed in the mare. The abnormality is known as dropsy, or hydrops, of the amnion and allantois. It is believed that this condition is usually related to chronic infections of the womb, occurring most frequently in animals that have been settled with difficulty or that have given birth to young several times. The condition seems more often to accompany twin pregnancy. Some animals affected with dropsy of the fetal membranes abort before full time, but the tendency seems to be for the condition to persist up to the time of expected normal parturition, and it may be apparent only during the last few months of pregnancy. Usually, it is not discovered until difficulty in foaling is encountered, the attendant having suspected twin pregnancy or an abnormally large fetus.

In such instances, the abdomen is large and pendulous, and the swelling fluctuates under pressure, though the solid body of the fetus may still be felt to strike against the hand pressed into the swelling.

On examination the womb is found to be tense and round, with the projecting rounded neck effaced. The rounded, swollen mass of the womb may be so firm and tense that the body of the fetus cannot be felt within it. The mare moves weakly and unsteadily, has difficulty in supporting the great weight, and in bad cases there may be loss of appetite, stocking (dropsy) of the hind legs, difficult breathing, and colicky pains. The bowels may be constipated and the urine scant, despite great thirst and the drinking of large quantities of water. The tension may lead to abortion, or a slow, laborious parturition may occur at the usual time.

Treatment.—This consists in relieving the tension and accumulation by puncturing the fetal membrane with a cannula and trocar introduced through the neck of the womb and the withdrawal of the trocar to leave the cannula in situ, or the membranes may be punctured with the finger and the excess liquid allowed to escape. This may bring on abortion, or the womb may close and gestation continue to the full term. Some animals will again attain enormous size and require the same treatment. In others, even the fetus becomes dropsical, thus doubly complicating successful delivery. If care is not taken in puncturing the membranes, some mares develop a putrefactive infection as a result of which, together with the swollen fetus, the uterus is unable to expel its contents. The veterinarian, once he has withdrawn the fluid, usually dilates the mouth of the womb, administers medicines to stimulate contractions of the uterus, and proceeds forthright with attempts to deliver the fetus. If this is dropsical or gas filled, embryotomy must be resorted to.

DROPSY OF THE LEGS, PERINEUM, AND ABDOMEN

The disposition to dropsy often shows itself in the hind legs and even in the forelegs, around and beneath the vulva (perineum), and beneath the abdomen and chest. This may attend the presence of albumin in the urine as a result of the overloading of the excretory organs by the burdened womb or nephritis. The affected parts are swollen and pit on pressure but are not especially tender. The swellings tend to subside following exercise, hand rubbing, and bandaging. The disturbance does not last more than a day or two after parturition unless it is due to serious organic disease or threatened rupture of the prepubian tendon.

RUPTURE OF THE PREPUBIAN TENDON

Some cases of dropsy of the abdomen that occur during pregnancy are an indication of abdominal strain which, if progressive, may cause rupture of the prepubian tendon, attached at the front of the bony framework of the pelvis. This apparently is more common in draft mares. Direct injury or strain is not often noticed to precede this

accident but does explain some cases. In considering causes, it should be realized that the weight of the abdominal contents often increases one-third or more in the late stages of pregnancy.

When the tendon ruptures, the entire abdominal wall drops, sometimes almost to the level of the hock joint. The pregnant uterus and the other organs contained within the abdomen drop down upon the skin and skin muscles, constituting a form of hernia. Many such mares, as well as their foals, die before the termination of pregnancy. In some cases, however, if the foal can be delivered promptly after the accident occurs, the mare may survive and be useful for light work. In some instances the threatened rupture of the tendon can be prevented if the danger is recognized early enough. This is accomplished by the application of a strong supporting bandage around the abdomen. The bandage is best made of strong material such as canvas, but a strong muslin sheet or a blanket may serve in an emergency. In addition to this, laxative feed may be given in limited quantities. If premature delivery of the fetus becomes necessary, a considerable task may be presented. Some animals suffering from severe shock and hemorrhage accompanying actual rupture of the tendon may best be killed in a humane manner to avoid needless suffering for the mare and expense to her owner.

In rare instances, a true hernia of sufficient size to permit the passage of intestines or even the pregnant womb into the formed sac may occur as a result of injury.

CRAMPS OF THE HIND LEGS

The pressure of the distended womb on the nerves and blood vessels of the pelvis, besides conducing to dropsy, occasionally causes cramps of the hind legs. The leg is raised without flexing the joints, the front of the hoof being directed toward the ground, or, the spasms occurring intermittently, the foot is kicked violently against the ground several times in rapid succession. The muscles are felt to be firm and rigid. The cramp may be relieved promptly by active rubbing or by walking the animal about, and it does not reappear after parturition.

CONSTIPATION

This may result from compression by the gravid womb or from improper feeding, and is best corrected by proper regulation of the diet, with exercise. A graduated allowance of boiled flaxseed may be given. Drastic purgatives should be avoided.

PARALYSIS

Pressure on the nerves of the pelvis may cause paralysis of the hind legs. These are obstinate until after parturition, when they

recover spontaneously or under a course of tonics and local stimulating liniments.

PROLONGED RETENTION OF THE FETUS

Though far less frequently than in the cow, parturition may not be completed at term, and the mare, to her serious and even fatal injury, may carry the foal in the womb for a number of additional months. Hamon records one case in which the mare died after carrying the fetus for 17 months, and Caillier a similar result after it had been carried 22 months. In these cases the fetus retained its natural form, but in one case reported by Gohier the bones only were left in the womb amid a mass of apparently purulent matter.

Cause.—The cause may be any effective obstruction to the act of parturition, such as lack of contractile power in the womb, wrong presentation of the fetus, contracted pelvis (from fracture or disease of the bones), or disease and induration of the neck of the womb. Perhaps the most common cause is infection of the womb that often follows chronic metritis.

The mere prolongation of gestation in the absence of infection does not necessarily entail the death of the foal; the latter has been born alive at the four-hundredth day. Even when the foal has died, putrefaction may not set in unless the membranes (water bags) have been ruptured and septic bacteria have been admitted to the interior of the womb. In the latter case a fetid decomposition advances rapidly, and the mare usually dies from poisoning with the putrid matters absorbed unless she receives prompt attention.

At the natural period of parturition preparations are apparently made for that act. The vulva swells and discharges much mucus, the udder enlarges, the belly becomes more pendent, and the animal strains more or less. No progress is made, however; there is not even an opening of the neck of the womb, and after a time the symptoms subside. The mare usually refuses the male, yet there are exceptions to this rule. If the neck of the womb has been opened and putrefying changes in its contents have set in, the mare loses appetite and condition, discharges an offensive material from the genital passages, and dies of inflammation of the womb and putrid infection. In other cases there is a slow wearing out of the strength, and she finally dies of exhaustion.

The treatment is such as will facilitate the expulsion of the fetus and its membranes and also includes treatment of the womb with suitable antiseptics. So long as the mouth of the womb is closed, time should be allowed for its natural dilatation, but if this does not come about after a day or two of straining, the opening must be dilated. The water bags may now be ruptured, any malpresentation rectified

(see "Difficult Parturition" page 170), and delivery effected. After removal of the membranes the womb is treated antiseptically.

This treatment may have to be repeated if a discharge persists. The same course may be pursued even after prolonged retention. If the soft parts of the fetus have been absorbed and only the bones left, these must be carefully sought for and removed, and subsequently daily irrigations may be required for some time. In such cases a course of tonics may be beneficial in restoring health and vigor.

ABORTION

Abortion is, strictly speaking, the expulsion of the impregnated ovum at any period prior to the time that the foal can survive out of the womb. If the foal is advanced enough to live, it is premature parturition, and in the mare this may occur as early as the tenth month (three-hundredth day).

Causes.—By far the most common cause of abortion in mares is infection, which to a large extent, may be prevented by certainty of the health of the mare and the stallion that are mated and by general hygiene and sanitation. There is a specific abortion disease in horses that is caused by a germ known as *Salmonella abortivo-equina*. In addition to this, infections with other organisms such as streptococci or even colon germs have been found as the cause of abortion in mares. In most cases it is believed that the infective germs were probably present at the time pregnancy began, in other words, that pregnancy occurred in spite of the infection only to be terminated by that infection by way of abortion. There is also some evidence that there is a form of abortion in breeding stables that may be due to a filtrable virus, an infective agent not visible by ordinary microscopic means and that will pass through the fine pores of a filter capable of holding back ordinary infective bacteria.

Aside from the abortions brought about by infection of the genital organs, the mare may abort by reason of almost any cause that very profoundly disturbs the system; hence, violent inflammations of important internal organs (bowels, kidneys, bladder, lungs) may induce abortion. Profuse diarrhea, whether occurring from the injudicious use of purgatives, the consumption of irritants in the feed, or a simple indigestion, is an effective cause. No less so is acute indigestion with evolution of gas in the intestines (bloating). The presence of stone in the kidneys, uterus, bladder, or urethra may induce so much sympathetic disorder in the womb as to induce abortion. In exceptional cases wherein mares come in heat during gestation, service by the stallion may cause abortion, although it is not uncommon for some pregnant mares to take the stallion repeatedly without the disturbance of an existing pregnancy. Blows or pressure on the

abdomen, rapid driving or riding of the pregnant mare, especially if she is soft and out of condition from idleness, the brutal use of the spur or whip, and the jolting and straining of travel by rail or boat may cause abortion. A painful surgical operation and the throwing and constraint resorted to for such an operation, as well as exhausting travel on muddy roads, slips and falls on ice, and jumping, are other causes. The stimulation of the abdominal organs by a full drink of ice water may precipitate a miscarriage, as may exposure to a cold rainstorm or a very cold night after a warm day. Irritant poisons that act on the urinary or genital organs, such as Spanish fly, rue, savin, tansy, cotton-root bark, ergot of rye or other grasses and, possibly, the smut of corn and other grain and various fungi in musty fodder are additional causes. Frosted or indigestible feed, and, above all, green succulent vegetables in a frozen state, have caused abortions. Filthy, stagnant water is also dangerous. However, infection of one sort or another is probably the basic cause of most of the abortions in mares as well as in other animals. The underlying weakness brought about by this infection may be increased abruptly by any of the several other possible causes of abortion that have been mentioned here.

Symptoms.—These vary mainly according to whether the abortion is early or late in pregnancy. In the first month or two of pregnancy the mare may miscarry without observable symptoms, and the fact appears only by her coming in heat. A closer observation may show a small clot of blood behind her, in which a careful search reveals the rudiments of a fetus. If the occurrence is somewhat later in gestation, there may be some general disturbance, loss of appetite, neighing, and straining, and the small body of the fetus is expelled, enveloped in its membranes. Abortions during the later stages of pregnancy are usually attended with greater constitutional disturbance, and the process resembles normal parturition, with the aggravation that more effort and straining are required to force the fetus through the comparatively incompletely dilated mouth of the womb. There is the swelling of the vulva, with mucus or even bloody discharge; the abdomen droops, the flanks fall in, the udder fills, the mare looks at her flanks, paws with the forefeet and kicks with the hind feet, switches the tail, moves around uneasily, lies down and rises, strains, and, as in natural foaling, expels first mucus and blood, then the waters, and finally the fetus. This may occupy an hour or two, or it may be prolonged for a day or more, the symptoms subsiding for a time, only to reappear with renewed energy. If there is malpresentation of the fetus it may hinder progress until rectified. Either abortion or difficult parturition may be followed by such complications as flooding, retention of the placenta, and leucorrhea.

The most important object in an impending abortion is to recognize it at as early a stage as possible, so that it may, if possible, be cut short and prevented. To the veterinarian, indefinable illness in a pregnant mare leads to a close examination of the vulva as regards swelling, vascularity of its mucous membrane, and profuse mucus secretion, and, above all, any streak or staining of blood; also the condition of the udder, if that is congested and swollen. Any such indications, with colicky pains, straining, however little, and active movement of the fetus or entire absence of movement, are suggestive symptoms.

The changes in the vulva and udder, with a soiled and bloody condition of the tail, may suggest that an abortion has already occurred, and the examination with the hand in the vagina may detect the mouth of the womb soft and dilatable and the interior of the organ slightly filled with a bloody liquid.

Treatment.—This should be mainly preventive. Animals showing indications of having aborted or of threatened abortion should be placed promptly in an isolated stall, but not the stall reserved for normal parturitions, so that any infection that may be present cannot be contracted by normal animals. The fetus, its membranes, and any discharge should be completely burned or deeply buried after being covered with quicklime. Some threatened abortions may be avoided by quiet, laxative diet and by periodic dosing with a sedative. Ergotized grasses should not be fed and any other deleterious feed should be eliminated.

When all measures fail and miscarriage proceeds, all that can be done is to assist in the removal of the fetus and its membranes, as in ordinary parturition. As in retention of the fetus, it may be necessary after delivery to inject antiseptics into the womb to counteract putrid fermentation. After abortion a careful hygiene is necessary, especially in the matter of sanitation and in providing easily digestible feed. The mare should not be served again for a month or longer, and in no case until after all discharge from the vulva has ceased.

It is wise to have mares and stallions examined at intervals for the detection of those infective inflammations that in addition to causing abortion may be associated with sterility, joint or navel ill, and other troubles. The feed, water, exercise, work, or other factors that may be involved in some cases of abortion are to be attended to and properly regulated. In cases of infectious abortion, whether due to specific or other infective agents, it may be best to promote the abortion so as better to get at the source of the trouble, the diseased genital organs.

INFECTIOUS ABORTION IN MARES

This disease is discussed in the chapter on Infectious Diseases, p.476.

PARTURITION

SYMPTOMS OF PARTURITION

As the period of parturition approaches, there is considerable swelling of the udder, the engorgement in exceptional cases extending forward on the lower surface of the abdomen and even into the hind legs. For about a week a serous fluid oozes from the teat and concretes as a yellow, waxlike mass around its orifice. About 24 hours before birth this gives place to a whitish, milky liquid, which falls upon and mats the hairs on the inner sides of the legs. Another symptom is enlargement of the vulva, with redness of its lining membrane, and the escape of glairy mucus. The belly droops, the flanks fall in, and the loins may even become depressed. Finally the mare becomes uneasy, stops feeding, looks anxious, whisks her tail, and may lie down and rise again. In many mares this is not repeated, but they remain down; violent contractions of the abdominal muscles ensue; after two or three pains the water bags appear and burst, followed by the forefeet of the foal, with the nose between the knees, and by a few more throes the fetus is expelled. In other cases the act is accomplished standing. The whole act may not occupy more than 5 or 10 minutes. This, together with the disposition of the mare to avoid observation, renders the act one that is rarely seen by the attendants.

The navel string, which connects the foal to the membranes, is ruptured when the fetus falls to the ground or when the mare rises if she has been down, and the membranes are expelled a few minutes later.

NATURAL PRESENTATION

When there is a single foal, the common and desirable presentation is with the forefeet first, the nose between the knees, and with the front of the hoofs and knees and the forehead directed upward toward the anus, tail, and croup (pl. XII, fig. 1). In this way the natural curvature of the body of the fetus corresponds to the curve of the womb and genital passages, and particularly of the bony pelvis, and the foal passes with much greater ease than if placed with its back downward toward the udder. When there is a twin birth, the second foal usually comes with its hind feet first, and the backs of the legs, the points of the hocks, and the tail and croup are turned upward toward the anus and tail of the mare (pl. XII, fig. 2). In this way, even with a posterior presentation, the curvature of the body of the foal still corresponds to that of the passages, and its expulsion may be almost as easy as in anterior presentation. Any presentation aside from these two may be said to be abnormal and will be considered under Difficult Parturition.

PREMATURE LABOR PAINS

These may be brought on by any violent exertion, use under the saddle, in heavy draft, in rapid paces, in travel by rail or sea, blows, kicks, or by crushing by other animals in a doorway or gate. Excessive action of purgative, or diuretic agents, or poisonous agents that irritate the bowels or kidneys, such as arsenic, paris green, mercury compounds, and all caustic salts and acids, is equally injurious. The ingestion or administration of agents that stimulate the action of the gravid womb may bring on labor pains prematurely. The same result may also follow expression of the corpus luteum, or yellow body, from the ovary. Finally, lack of certain vitamins may be responsible.

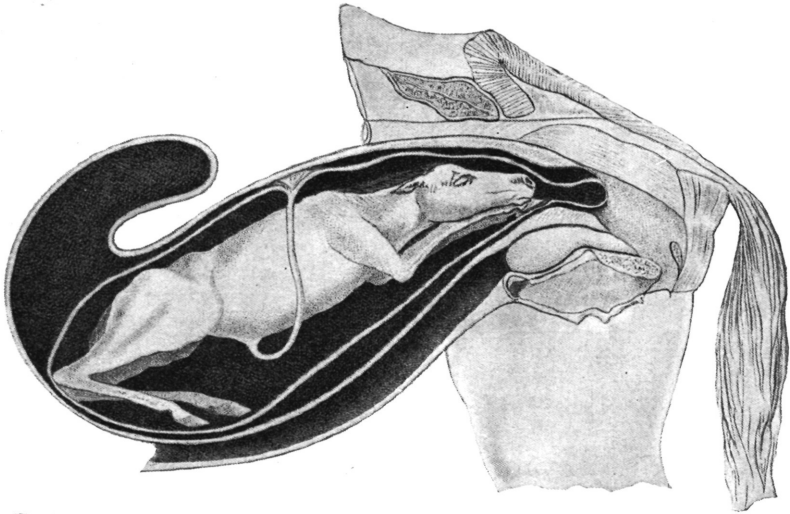
In comparison with parturition, there will be less enlargement, redness, and swelling of the vulva, less mucous discharge, less filling of the udder, and fewer appearances of wax and probably none of milk from the ends of the teats. The oiled hand introduced into the vulva will not enter with the ease usual at full term, and the neck of the womb will be felt not only closed, but with its projecting papillae, through which it is perforated, not yet flattened down and effaced, as at full term. The symptoms are, indeed, those of threatened abortion, but at such an advanced stage of gestation as is compatible with the survival of the offspring.

Treatment.—The treatment consists in the separation of the mare, in a quiet, dark, secluded place, from all other animals. Sedatives may be given for several days after the urgent symptoms have subsided. Should parturition become inevitable any necessary assistance should be furnished.

DIFFICULT PARTURITION (DYSTOCIA)

With natural presentation difficult parturition is a rare occurrence. The great length of the forelegs and face entails, in the anterior presentation, the formation of a long cone, which dilates and glides through the passages with comparative ease. Even with the hind feet first a similar conical form is presented, and the process is rendered easy and quick. As has been pointed out before, the failure of a mare to deliver her foal promptly is usually indicative of abnormalities. The recognition and correction of these are essentially a procedure for one trained and skilled in obstetrics (the science of the care of pregnancy, delivery of the young, and care during the after period). Whenever possible, a veterinarian should attend the mare in difficulty at the time of foaling. If a veterinarian is available, nothing more than the provision of a clean, comfortable stall for the animal and the preparation of a quantity of boiled water should be done before his arrival. To attach a rope to any part of the foal for the purpose of pulling, before the exact position of the fetus is fully determined, may tear the womb or the vagina and later,

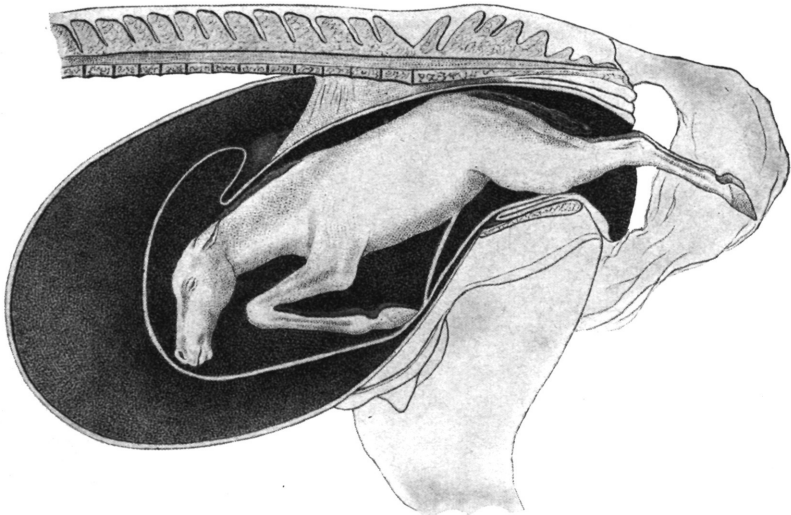
1



after Fleming.

Vertebro-sacral presentation.

2



Haines, del.

Lumbo-sacral presentation.

NORMAL PRESENTATIONS.

when it is found that the foal cannot be delivered without expert assistance, the veterinarian is called upon to treat a more or less hopeless case.

Difficulty and danger arise mainly from the act being brought on prematurely before the passages are sufficiently dilated, from narrowing of the pelvic bones or other mechanical obstruction in the passages, from monstrous distortions or duplications in the fetus, or from the turning back of a leg or the head so that the elongated conical or wedge-shaped outline is done away with. Difficult and delayed parturitions are surrounded by special dangers and require unusual precautions and skill. In view of the tendency of the mare to excessive inflammations of the peritoneum and other abdominal organs, penetrating wounds of the womb or vagina are likely to prove fatal. The contractions of the womb and abdominal walls are so powerful as to exhaust and benumb the arm of the assistant and possibly to cause penetrating wounds of the genital organs. By reason of the looser connection of the fetal membranes with the womb, as compared with those of ruminants, the violent throes early detach these membranes throughout their whole extent, and the foal, being thus separated from the mother and thrown on its own resources, dies at an early stage of any protracted parturition. The undelivered foal rarely survives more than an hour after labor has become well established. Because of the great length of the legs and neck of the foal, it is extremely difficult to secure and bring up a leg or the head that has been turned back, but it is imperative in most cases that this be accomplished before assistance in delivery is undertaken.

When assistance must be rendered, the operator usually dons clean, protective, sleeveless clothing. This protects the body and leaves the whole arm free for manipulation. In this operation strict cleanliness is absolutely essential. Before the arm is inserted, it should be thoroughly cleansed with soap and warm water, with scrubbing, particularly around the finger nails, after which it may be smeared with carbolated petrolatum or other antiseptic lubricant. This protects the skin against septic infection and favors the introduction of the hand and arm.

The hand should be inserted with the thumb and fingers drawn together like a cone. Whether standing or lying, the mare should be turned with head downhill and hind parts raised as much as possible. The contents of the abdomen gravitating forward leave much more room for manipulation. The rear quarters of the mare should be thoroughly washed with soap and warm water or a mild antiseptic solution. The tail may well be bandaged with sterile gauze and held or tied to one side. Whatever part of the foal is presented (head, foot) may be secured with a cord or chain and running noose before it is

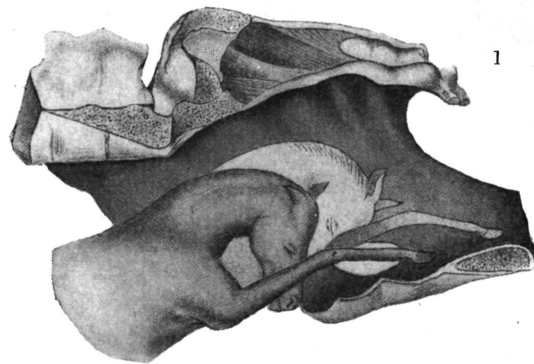
pushed back to search for the other parts. Even if such a part is reached, no attempt is usually made to bring it up during a labor pain. Pinching the back will sometimes check the pains and allow the operator to secure and bring up the missing member. In intractable cases a large dose of chloral hydrate (1 ounce in a quart of water) or the inhalation of chloroform and air (equal proportions) to insensibility may obtain a respite, during which the members out of position may be brought into proper place. Other relaxants and anesthetics are also used. If the waters have been discharged and the mucus dried up, it may be necessary to lubricate the genital passages and body of the fetus with a sterile or antiseptic lubricant before any attempt at extraction is made. When the missing member has been brought up into position and presentation has been rendered natural, traction on the fetus must be made only during a labor pain. If a mare is inclined to kick, it may be necessary to apply hobbles to protect the operator.

Narrow pelvis.—A disproportion between the fetus got by a large stallion and the pelvis of a small dam is a serious obstacle to parturition, sometimes seen in the mare. This is not the rule, however, as the foal up to birth usually accommodates itself to the size of the dam, as illustrated in the successful crossing of large draft stallions on mustang mares. If the disproportion is too great the only resort is embryotomy or Caesarian section (removal of the foal through an abdominal incision).

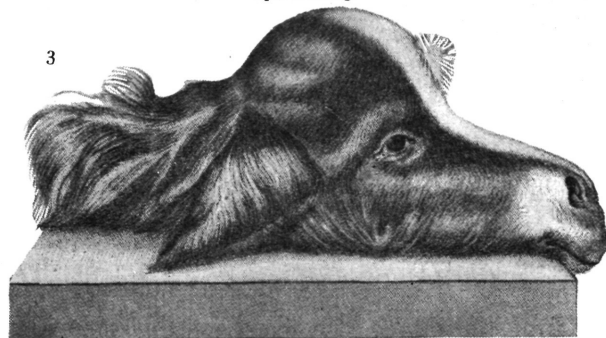
More commonly the obstruction comes from distortion and narrowing of the pelvis as the result of fractures (pl. XIII, fig. 2). Fractures at any point of the lateral wall or floor of the pelvis are repaired with the formation of an extensive bony deposit bulging into the passage of the pelvis. The displacement of the ends of the broken bone is another cause of constriction, and between the two conditions the passage of the fetus may be rendered impossible without embryotomy or Caesarian section. Fracture of the sacrum (the continuation of the backbone forming the croup) leads to the depression of the posterior part of that bone in the roof of the pelvis and the narrowing of the passage from above downward by a bony ridge presenting its sharp edge forward.

In all cases in which there has been injury to the bones of the pelvis, the obvious precaution is to withhold the mare from breeding and to use her for work only.

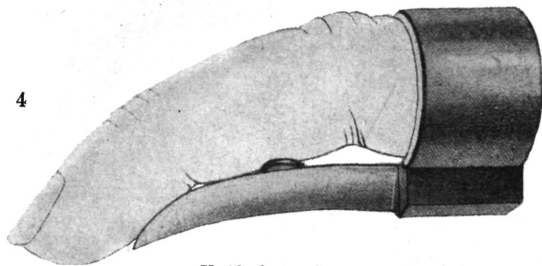
If a mare with a pelvis thus narrowed has got in foal inadvertently, abortion may be induced in the early months of gestation. In some cases this may be accomplished by the veterinarian through dilation of the neck of the womb and rupture of the water bag, but often the administration of pituitrin, an extract made from the pituitary gland,



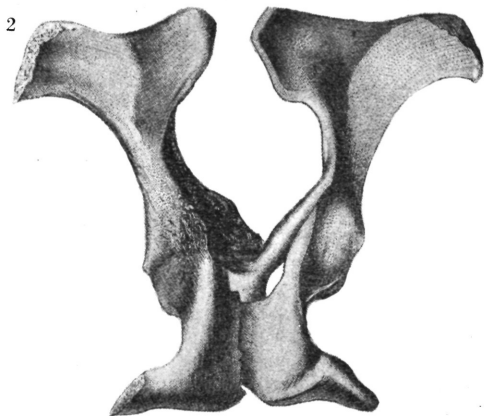
Anterior presentation. Downward deviation of the head.
After Fleming.



Hydrocephalic head of colt.
After Fleming.



Knife for embryotomy.
(Original.)



Deformed pelvis.
After Fleming.

SOME FACTORS IN DIFFICULT LABOR.

or manipulations of the ovary must be resorted to before the womb contracts enough to expel the fetus.

Tumors in vagina and pelvis.—Tumors of various kinds may form in the vagina or elsewhere within the pelvis, and when large enough will obstruct or prevent the passage of the fetus. Gray mares, which are subject to black pigment tumors (melanosis) on the tail, anus, and vulva, are the most likely to suffer from this. The wall of the vagina rarely becomes relaxed, and being pressed by a mass of intestines, will protrude through the lips of the vulva as a hernial sac, containing a part of the bowels. If a tumor is small it may only retard and not absolutely prevent parturition. A hernial protrusion of the wall of the vagina may be pressed back and emptied, so that the body of the fetus engaging in the passage may find no further obstacle. When a tumor is too large to allow delivery the only resort is to remove it, but before proceeding it must be clearly made out that the obstruction is a mass of diseased tissue and not a sac containing intestines. If the tumor hangs by a neck it can sometimes be safely removed.

Hernia of womb.—The rupture of the musculo-fibrous floor of the belly and the escape of the gravid womb into a sac formed by the peritoneum and skin hanging toward the ground are described by all veterinary obstetricians, yet this condition is rarely seen in the mare. The form of the fetus can be felt through the walls of the sac, so that it is easy to recognize the condition. Its cause is usually external violence, though it may begin with an umbilical hernia. When the period of parturition arrives, the first effort should be to return the fetus within the proper abdominal cavity, and this can sometimes be accomplished with the aid of a stout blanket gradually tightened around the belly. This failing, the mare may be placed on her side or back and gravitation brought to the aid of manipulation in effecting the return. Even after the hernia has been reduced the relaxed state of the womb and abdominal walls may serve to hinder parturition. In this case the fetus must be brought into position, and traction coincident with the labor pains employed to produce delivery.

Twisting of neck of womb (torsion of the womb).—This condition is uncommon in the mare, though occasionally seen in the cow, owing to the greater laxity of the broad ligaments of the womb in that animal. It consists in a revolution of the womb on its own axis, so that its right or left side will be turned upward (quarter revolution), or the lower surface may be turned upward and the upper surface downward (half revolution). The effect is to throw the narrow neck of the womb into a series of spiral folds, turning in the direction in which the womb has revolved, closing the neck and rendering distention and dilatation impossible.

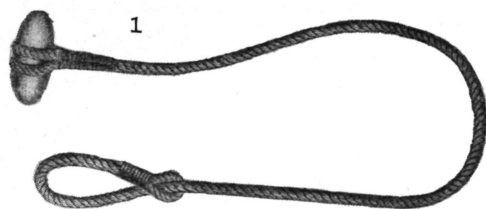
The period and pains of parturition arrive, but in spite of continued efforts no progress is made, neither water bags nor liquids appearing.

The spiral direction of the folds is detected by introduction of the hand into the vagina or palpation through the wall of the rectum.

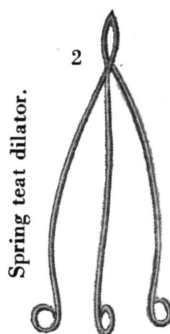
The method of relief that is used successfully in the cow may be equally effective in the mare. The dam is placed (with her head uphill) on her right side if the upper folds of the spiral turn toward the right, and on her left side if they turn toward the left, and the hand is introduced through the neck of the womb. A leg or other part of the body of the fetus is held and pressed against the wall of the womb, while two or three assistants turn the animal over on her back toward the other side. The object is to keep the womb stationary while the animal is rolling. If success attends the effort, the constriction around the arm is suddenly relaxed, the spiral folds are effaced, and the water bags and fetus press forward into the passage. If the first attempt does not succeed, it may be repeated again and again until successful. Some causes of failure are the prior death and decomposition of the fetus, with the formation of gas and over-distention of the womb, and the supervention of inflammation and inflammatory exudation around the neck of the womb, which hinders untwisting. The first of these conditions occurs early in the mare from the detachment of the fetal membranes from the wall of the womb; and as she is more subject to fatal peritonitis than the cow, both these sources of failure are more probable in the mare.

When the case is intractable, though the hand may be easily introduced, the instrument shown in plate XIV, figure 7, may be used. Each hole at the small end of the instrument has passed through it a stout cord with a running noose, to be passed around two feet or other portion of the fetus that it may be possible to reach. The cords are then drawn tight and fixed around the handle of the instrument; then by using the cross handle as a lever, the fetus and womb may be rotated in a direction opposite to that causing the obstruction. During this process the hand is introduced to feel when the twist has been undone. This method may be supplemented, if necessary, by rolling the mare as described above. In some cases, if attended early, an operation may be performed. This consists in opening the abdominal cavity and correcting the torsion through the opening made in the abdominal wall. This is a serious operation to be undertaken only by a veterinarian and then only very early in labor.

Effusion of blood in vaginal walls.—This is common as a result of difficult parturition, but it may occur from local injury before that act and may seriously interfere with it. This condition may be recognized by the soft, doughy swelling so characteristic of blood clots and by the dark-red color of the mucous membrane. Success has been obtained by opening such swellings as late as 10 days before parturition, evacuating the clots, and dressing the wound daily with



Schaack's traction cord.



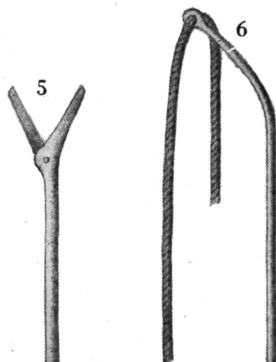
Spring teat dilator.



Ring teat-siphon.



Loop of Delwart's truss.



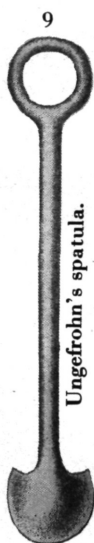
Curved carrier with cord.



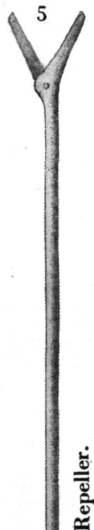
Simple short crotchet-forceps.



Simple long crotchet-forceps.



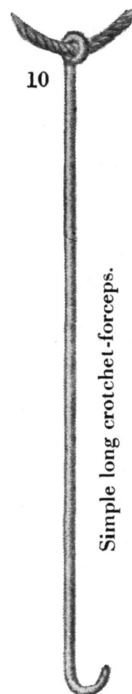
Ungefrohn's spatula.



Repeller.



Instrument used to rotate the foetus.



Haines, del. after Fleming.

INSTRUMENTS USED IN DIFFICULT LABOR.

an astringent lotion. A similar procedure may be followed, if necessary, during parturition. It is essential, of course, to be certain that the swelling present is actually due to collection of clotted blood and not a prolapsed organ before any such treatment is undertaken.

Calculus (stone) and tumor in bladder.—The pressure on the bladder containing a stone or a tumor may be so painful that the mare will voluntarily suppress the labor pains to some extent. Examination of the bladder with the finger introduced through the urethra will usually detect the offending agent. A stone may be extracted with forceps (see Lithotomy). The large papillary tumors that are sometimes found in the mare's bladder may be delicate in texture and may be removed piecemeal by forceps. Fortunately, mares affected in this way rarely breed.

Fecal impaction of rectum.—In some animals, with more or less paralysis or weakness of the tail and rectum, the rectum may become so impacted with solid feces that the mare is unable to discharge them, and the accumulation both by reason of the mechanical obstruction and the pain caused by pressure on it will delay or impede labor pains. The rounded swelling surrounding the anus will at once suggest the condition, when the obstruction may be removed by the well-oiled or well-soaped hand and enemas.

Spasm of neck of womb.—This may occur in the mare of especially excitable temperament but more often under particular causes of irritation, local or general. Labor pains, though continuing for some time, produce no dilation of the neck of the womb, which is firmly closed so as to admit but one or two fingers. The projection at the mouth of the womb may have been entirely effaced, so that a simple round opening is left, with rigid margins.

The simplest treatment consists in smearing this part with a sedative preparation, and after an interval inserting the hand with fingers and thumb drawn into the form of a cone, rupturing the membranes, and bringing the fetus into position for extraction, as described under Prolonged Retention of the Fetus. Another mode is to insert through the neck of the womb an ovoid rubber bag, empty, and furnished with an elastic tube 12 feet long. The free end of this tube is held to a height of 8, 10, or 12 feet. A funnel is inserted into it, and the bag is distended with tepid or warm water.

Fibrous bands constricting or crossing neck of womb.—These bands, occurring as the result of disease, have occasionally been observed in the mare. They may exist in the cavity of the abdomen and compress and obstruct the neck of the womb, or they may extend from side to side of the vagina across and just behind the neck of the womb. In the latter position they may be felt and quickly remedied by cutting them across. In the abdomen they can be reached only by

incision, and two alternatives are presented: (1) To perform embryotomy and extract the fetus piecemeal, and (2) to make an incision into the abdomen and extract by the Caesarean operation, or simply to cut the constricting band and attempt delivery by the usual channel.

Fibrous constriction of vagina or vulva.—This is probably always the result of direct mechanical injury and the formation of rigid scar tissue that fails to dilate with the remainder of the passages at the approach of parturition. The presentation of the fetus in the natural way and the occurrence of successive and active labor pains without any favorable result will direct attention to the rigid and unyielding cicatrices that may be incised at one, two, or more points to a depth of half an inch or more, after which the natural expulsive efforts will usually prove effective. The resulting wounds are treated antiseptically following delivery of the foal.

Fetus adherent to walls of womb.—In inflammation of the mucous membrane lining the cavity of the womb and implicating the fetal membranes, the resulting embryonic tissue sometimes establishes a medium of direct continuity between the womb and fetal membranes. The blood vessels of the one communicate freely with those of the other and the fibers of the one are prolonged into the other. This causes retention of the membranes after birth, and a special risk of bleeding from the womb and of septic poisoning. In exceptional cases the adhesion is more extensive and binds a portion of the body of the foal firmly to the womb. In such cases attempts to extract the foal have been found to be impossible until such adhesions were broken down. If they can be reached with the hand and recognized, they may be torn through with the fingers or with a blunt hook, after which delivery may be attempted with some hope of success.

Excessive size of fetus.—A small mare may usually be safely bred to a large stallion, but when small size is an individual rather than a racial characteristic or the result of being very young, the rule cannot be expected to hold. There is always great danger in breeding the young, small, and undeveloped female and the dwarfed representative of a larger breed, as the offspring tend to partake of the characteristics of the larger race and to show them even prior to birth. When impregnation has occurred in the very young or in the dwarfed female there are two alternatives—to induce abortion or to wait until there are attempts at parturition and to extract by embryotomy if impracticable otherwise.

Constriction of a body part by navel cord.—Winding of the umbilical cord around a member of the fetus sometimes leads to its amputation. The cord sometimes gets wound around the neck or a leg at birth, but in the mare this does not seriously impede parturition, as the loosely attached membranes are easily separated from the womb and no

strangulation or retarding occurs. The foal, however, may die from the cessation of the placental circulation unless it is speedily delivered.

Water in the head (hydrocephalus) of the foal.—This consists in the excessive accumulation of liquid in the cranial cavity so that it is enlarged and a great, projecting, rounded mass occupies the space from the eyes upward (pl. XIII, fig. 3). With an anterior presentation (forefeet and nose) this may be an insuperable obstacle to progress, as the malformed cranium is too large to enter the pelvis at the same time with the forelegs. With a posterior presentation (hind feet) all goes well until the body and shoulders have passed out, when progress is suddenly arrested by the great bulk of the head. In the first case, the hand introduced along the face detects the enormous size of the head, which may be diminished by puncturing with a knife or trocar and cannula in the median line, evacuating the water, and pressing in the thin, bony walls. With a posterior presentation, the same course must be followed; the hand passed along the neck detects the cranial swelling. Oftentimes with an anterior presentation the great size of the head leads to its displacement backward, and thus the forelegs alone engage in the passages. Here the first object is to seek and bring up the missing head and then puncture it as above suggested.

Ascites, or dropsy of abdomen in the foal.—The accumulation of liquid in the abdominal cavity of the fetus is less frequent than hydrocephalus, but when it is present it may arrest parturition as completely as will hydrocephalus. With an anterior presentation the foal may pass as far as the shoulders, but behind this all efforts fail to effect a further advance. With a posterior presentation the hind legs as far as the thighs may be expelled, but at this point all progress ceases. In either case the hand, passed inward by the side of the foal, will detect the enormous distention of the abdomen and its soft, fluctuating contents. The only course is to puncture the cavity and evacuate the liquid. With the anterior presentation this may be done with a long trocar and cannula, introduced through the chest and diaphragm, or with a knife an incision may be made between the first two ribs and the lungs and heart cut or torn out, when the diaphragm will be felt projecting strongly forward, and may be easily punctured. Should there not be room to introduce the hand through the chest, the hand may be passed along beneath the breast-bone and the abdomen punctured. With a posterior presentation the abdomen must be punctured in the same way, the hand, armed with a knife protected in its palm, being passed along the side of the flank or between the hind legs. Moderate dropsy of the abdomen is not incompatible with natural delivery, the liquid being at first crowded back into the portion of the belly still engaged in the womb,

and passing slowly from that into the advanced portion as soon as that has cleared the narrow passage of the pelvis and passed out where it can expand.

General dropsy of the fetus.—In this case the tissues generally are distended with liquid, and the skin at all points is tense and rounded and pits on pressure with the fingers. In some such cases delivery may be effected after the skin has been punctured at narrow intervals to allow the escape of the fluid and then liberally smeared with a sterile or antiseptic lubricant. More commonly, however, it cannot be reached at all points to be so punctured nor sufficiently reduced to be extracted whole, and resort must be had to embryotomy.

Emphysema (swelling of the fetus with gas).—This has been described as occurring in a living fetus, but it usually occurs in the dead and decomposing foal after futile efforts had been made for several days to effect delivery. These cases merit little hope, as the foal is inflated to such an extent that it is impossible to advance it into the passages, and the skin of the fetus and the walls of the womb and vagina have become so dry that it is impracticable to cause the one to glide on the other. The hair comes off any part that may be seized, and the case is rendered offensive and dangerous to the operator. The only resort is embryotomy. The longer this is delayed, the less the chance of saving the mare.

Contractions of muscles.—The foal is not always developed symmetrically; certain groups of muscles may remain short or may shorten because of persistent spasmodic contraction, so that even the bones become distorted and twisted. This is most common in the neck. The bones of this part and even of the face are drawn to one side and shortened, the head being held firmly to the flank and the jaws being twisted to the right or left. In other cases the flexor muscles of the forelegs are contracted so that the latter are strongly bent at the knee. In neither of these cases can the distorted part be extended and straightened, so that the body or legs must necessarily be presented double, and natural delivery is rendered impossible in all but rare cases. The bent neck may sometimes be straightened after the muscles have been cut on the side to which it is turned, and the bent limbs after the tendons on the back of the shank bone have been cut across. If failure results, the next resort is embryotomy.

Enclosed ovum (tumors of the fetus).—Tumors or diseased growths may form on any part of the foal, internal or external, and by their size impede or hinder parturition. In some cases what appears as a tumor is an imprisoned and undeveloped ovum that has grafted itself on the fetus. These are usually sacculated and may contain skin, hair, muscles, bone, and other natural tissues. The only course to be pursued in such cases is to excise the tumor, or, if this is not feasible, to perform embryotomy.

Monstrosities.—Monstrosity in the foal is an occasional cause of difficult parturition, especially such monsters as show excessive development of some part of the body, a displacement or distortion of parts, or a redundancy of parts, as in double monsters. Monsters may be divided into—

(1) Monsters with absence of parts—absence of head, leg, or other organ.

(2) Monsters with some part abnormally small—dwarfed head, leg, trunk, etc.

(3) Monsters through unnatural division of parts—cleft head, trunk, legs, etc.

(4) Monsters through absence of natural divisions—absence of mouth, nose, eyes, anus, etc.

(5) Monsters through fusion of parts—one central eye, one nasal opening, etc.

(6) Monsters through abnormal position or form of parts—curved spine, face, legs, etc.

(7) Monsters through excess of formation—enormous head, extra digits, etc.

(8) Monsters through imperfect differentiation of sexual organs—hermaphrodites.

(9) Double monsters—double-headed, double-bodied, extra legs, etc.

The causes of monstrosities are varied. Some monstrosities, resulting from extra digits, absence of tail, etc., run in families and are produced almost as certainly as color or form. Others are associated with too close breeding, the powers of symmetrical development being interfered with, just as in other cases a sexual incompatibility is developed, near relatives failing to breed with each other. Mere arrest of development of a part may arise from accidental disease of the embryo; hence vital organs or portions of organs, such as the dividing walls of the heart, are omitted. Sometimes an older fetus is enclosed in the body of another, each having begun independently from a separate ovum, but the one became embedded in the semifluid mass of the other and developed there simultaneously with it but not to so great a size nor so perfectly. In many cases of redundancy of parts the extra part has manifestly developed from the same ovum and nutrient center with the normal part to which it remains adherent. In the early embryo, with its great powers of development, this factor can operate to far greater purpose than in the adult animal. Its influence is seen in the fact pointed out by St. Hilaire that such redundant parts are nearly always connected with the corresponding portions in the normal fetus. Thus superfluous legs or digits are attached to the normal ones, double heads or tails are connected to a common neck or rump, and double

bodies are attached to each other by corresponding points, navel to navel, breast to breast, back to back. All this suggests the development of extra parts from the same primary layer of the impregnated and developing ovum. The effect of disturbing conditions in giving such wrong directions to the developmental forces is well shown in the experiments of St. Hilaire and Valentine in breaking up the natural connections in eggs, and thereby determining the formation of monstrosities at will. So, in the mammal, blows and other injuries that detach the fetal membranes from the walls of the womb or that modify their circulation by inducing inflammation are at times followed by the development of a monster.

The monstrous forms likely to interfere with parturition are those which, from contracted or twisted legs or spine, must be presented double; those in which the extra legs, head, or body must approach the passages with the natural ones; cases in which a head or other member has attained an unnatural size; and those in which the body of one fetus has become enclosed in or attached to another.

Extraction is sometimes possible by straightening the parts and obtaining such a presentation as will reduce the presenting mass to its smallest and most wedgelike dimensions. To effect this it may be necessary to cut the flexor tendons of bent legs or the muscles on the side of a twisted neck or body; one or more of the manipulations necessary to secure and bring up a missing member may be required. In most cases of monstrosity by excess, however, it is necessary to remove the superfluous parts, in which case the general principles employed for embryotomy must be followed. Caesarean section, by which the fetus is extracted through an incision in the walls of the abdomen and womb, is practicable in some cases. The object in any event should be to save the mare, disregarding the life of the monster.

Entrance of twins into the passage at once.—Twins are rare in the mare, and still more rare is the impaction of both at once into the pelvis. The condition may be recognized by the fact that two forelegs and two hind legs occupy the passage at once, the front of the hoofs of the forefeet being turned upward and those of the hind feet downward. If both belonged to one foal, they would be turned in the same direction. Once recognized, the condition may be remedied by passing a rope with a running noose round each foot of the foal that is furthest advanced or that promises to be most easily extracted, and to push the legs of the other fetus back into the depth of the womb. As soon as the one fetus is fully engaged into the passage it will hold its place and its delivery will proceed in the natural way. If this is impossible embryotomy must be resorted to.

ABNORMAL PRESENTATIONS

Abnormal presentations may be tabulated as follows:

Anterior presentations	Foreleg-----	{ Incompletely extended. Flexor tendons shortened.
		{ Crossed over the neck
		{ Bent back at the knee.
	Head-----	{ Bent back from the shoulder.
		{ Bent downward on the neck.
		{ Head and neck turned back beneath the breast.
		{ Turned to one side.
Posterior presentations		{ Turned upward and backward on the back.
	Hind leg-----	Hind feet engaged in the pelvis.
	Transverse-----	Back of foal to side of pelvis.
	Inverted-----	Back of foal to floor of pelvis.
	Hind leg-----	{ Bent on itself at the hock.
		{ Bent at the hip.
	Transverse-----	Back of foal to side of pelvis.
Transverse presentation of body---	Inverted-----	Back of foal to floor of pelvis.
		{ With back and loins presented.
		{ With breast and belly presented.

Forelegs incompletely extended.—In cases of this kind, not only may the back tendons behind the knee and shank bone be unduly short, but the sinew extending from the front of the shoulder blade over the front of the elbow and down to the head of the shank bone may also be shortened. The result is that the foreleg is bent at the knee and the elbow is also rigidly bent. The condition obstructs parturition by the feet becoming pressed against the floor of the pelvis or by the elbow pressing on its anterior brim. Relief is to be obtained by forcible extention. A rope with a running noose is passed around each fetlock and a repeller (pl. XIV) planted in the breast is pressed in a direction upward and backward while active traction is made on the ropes. If the feet are not thereby raised from the floor of the pelvis, the palm of the hand may be placed beneath them to protect the mucous membrane until they have advanced sufficiently to obviate this danger. In the absence of a repeller, a properly cleansed, smooth, rounded, fork handle may be used if care is taken. If the shortening is too great to allow the extension of the legs in this way, the tense tendons may be cut across behind the shank bone and in front of the elbow, and the limb will be easily straightened out. This is most easily done with an embryotomy knife of such design that the blade may be protected in the palm of the hand (pl. XIII, fig. 4).

Foreleg crossed over back of neck.—With the long forelegs of the foal this readily occurs, and the resulting increase in thickness, both at the head and shoulder, offers a serious obstacle to progress (pl. XV, fig. 2). The hand introduced into the passage detects the head and one forefoot, and farther back on the same side of the head the second

foot, from which the leg may be traced obliquely across the back of the neck.

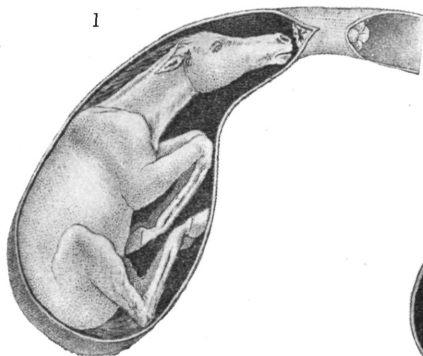
If parturition continues to make progress the displaced foot may bruise, lacerate, or even perforate the vagina. By seizing the leg above the fetlock one may push it over the head to the proper side, when parturition will proceed normally.

Foreleg bent at knee.—The nose and one forefoot are presented, and on examination the knee of the missing foreleg is found farther back (pl. XV, fig. 1). A loop is placed on the presenting pastern and another on the lower jaw, and the body of the fetus pushed back with a repeller, while the operator, seizing the shank of the bent leg, extends it so as to press back the knee and bring forward the fetlock and foot. As progress is made little by little the hand is slid down from the region of the knee to the fetlock, and finally that is secured and brought up into the passage, when parturition will proceed without hindrance. If both forelegs are bent back the head must be noosed and the legs brought up as previously described, one after the other. It is usually best to use the left hand for the right foreleg, and the right hand for the left foreleg.

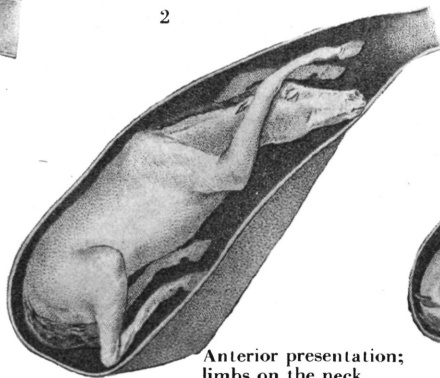
Foreleg turned back from shoulders.—In this case, on exploration by the side of the head and presenting leg, the shoulder only can be reached at first (pl. XV, fig. 4). By noosing the head and the presenting foreleg, they may be drawn forward into the pelvis, and the hand being carried along the shoulder in the direction of the missing leg is enabled to reach and seize the forearm just below the elbow. The body is now pushed back by the assistant pressing on the head and the presenting leg or on a repeller planted in the breast until the knee can be brought up into the pelvis, after which the procedure is the same as described in the last paragraph.

Head bent down between forelegs.—The bending may be such that the poll or nape of the neck, with the ears, can be felt far back between the forelegs, or such that only the upper border of the neck can be reached, head and neck being bent back beneath the body. With the head only bent on the neck the two presenting legs are noosed, then the hand is introduced between them until the nose can be seized in the palm of the hand. The assistants push back the presenting legs, while the nose is strongly lifted upward over the brim of the pelvis. This accomplished, the nose assumes the natural position.

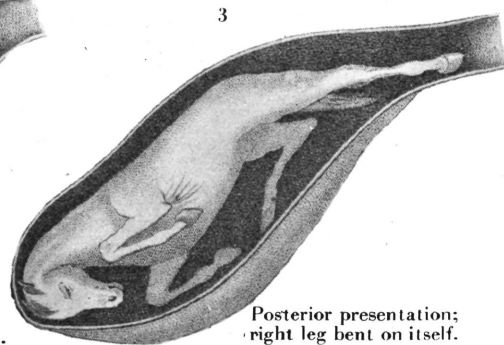
When both head and neck are bent downward it may be impossible to reach the nose. If, however, the labor has only commenced, the legs may be drawn upon until the operator can reach the ear, by dragging on which the head may be so far advanced that the fingers may reach the orbit. Traction upon this while the legs are being pushed back may bring the head up so that it bends on the neck only, and the further procedure will be as described in the last paragraph.



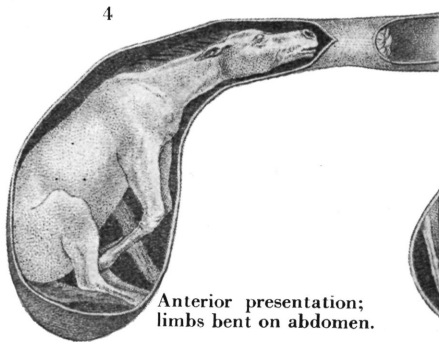
Anterior presentation;
limbs bent on breast.



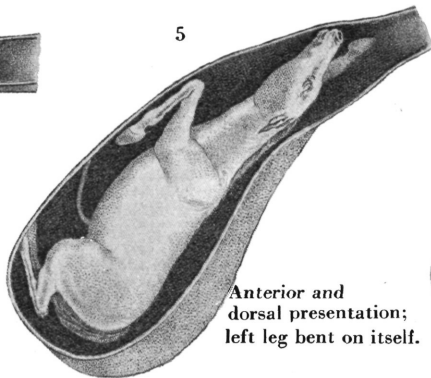
Anterior presentation;
limbs on the neck.



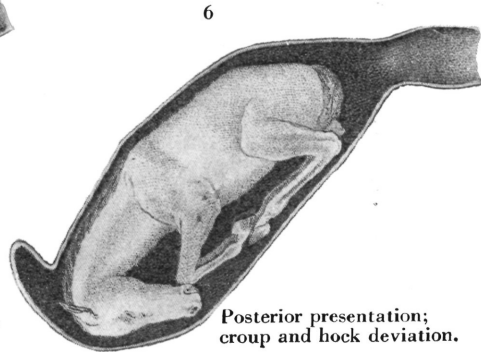
Posterior presentation;
right leg bent on itself.



Anterior presentation;
limbs bent on abdomen.



Anterior and
dorsal presentation;
left leg bent on itself.

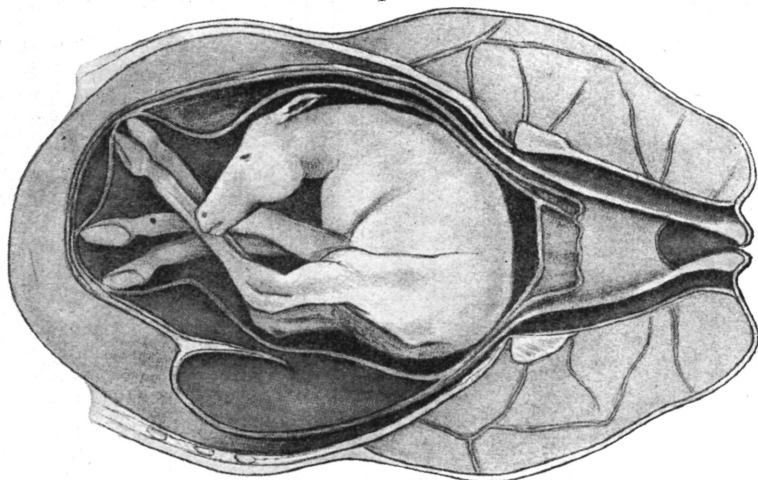


Posterior presentation;
croup and hock deviation.

Haines, del. after D'Arboval.

ABNORMAL PRESENTATIONS.

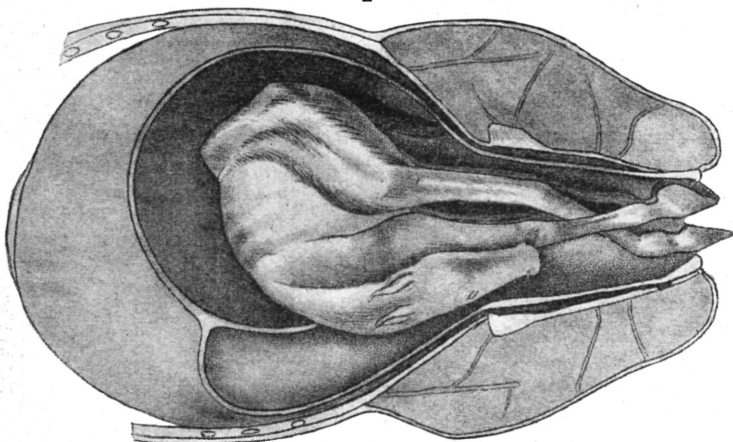
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After Fleming.

1, Transverse presentation—upper view.

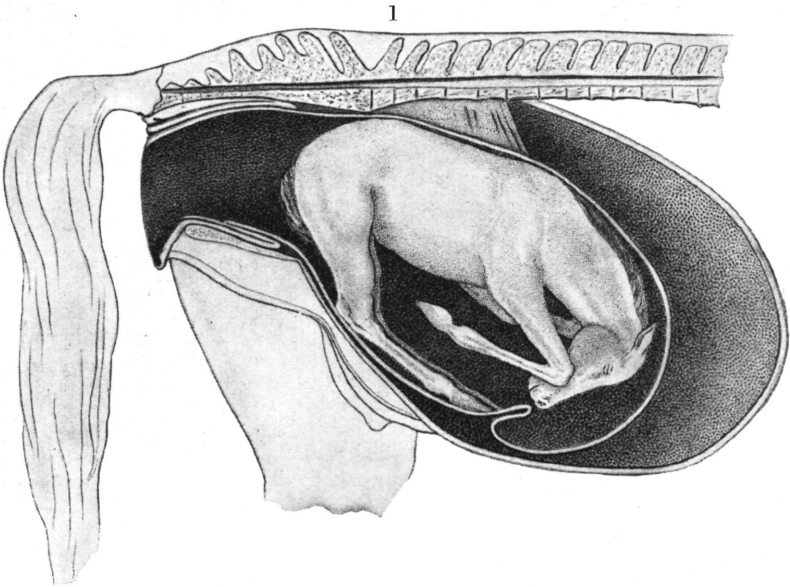
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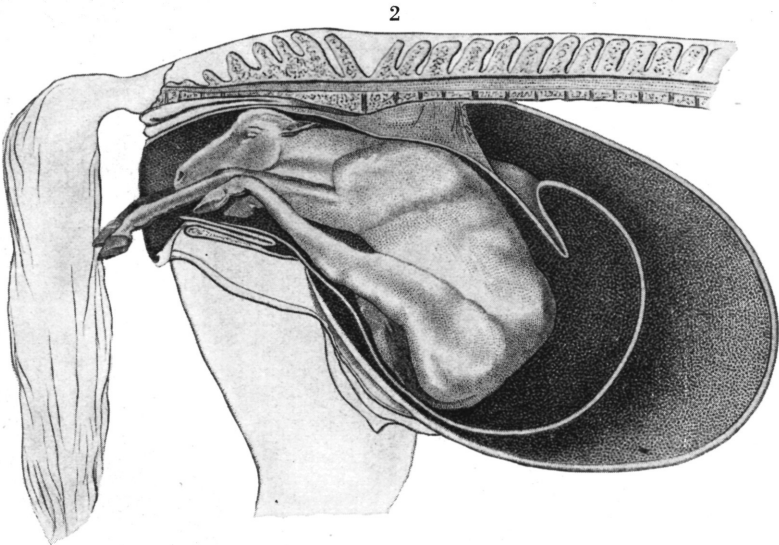
After Fleming.

2, Sterno-abdominal presentation—head and feet engaged.
Haines, after Fleming.

ABNORMAL PRESENTATIONS.



Thigh and croup presentation.

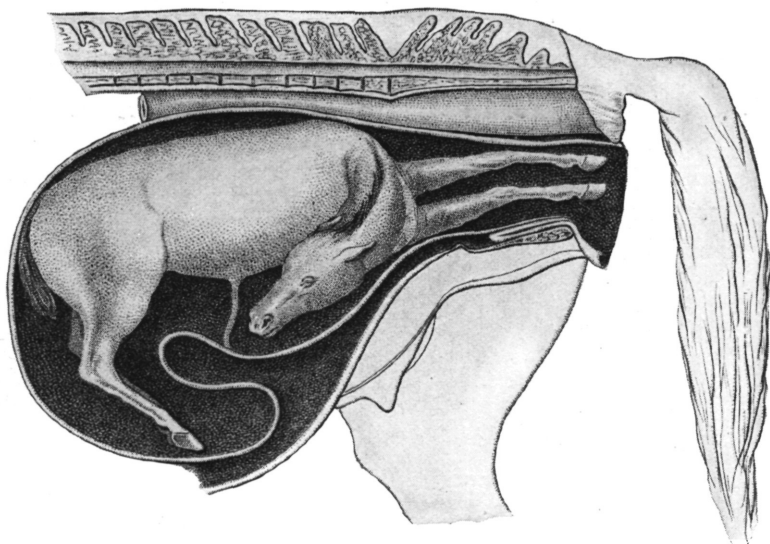


Anterior presentation. High-limb deviation.

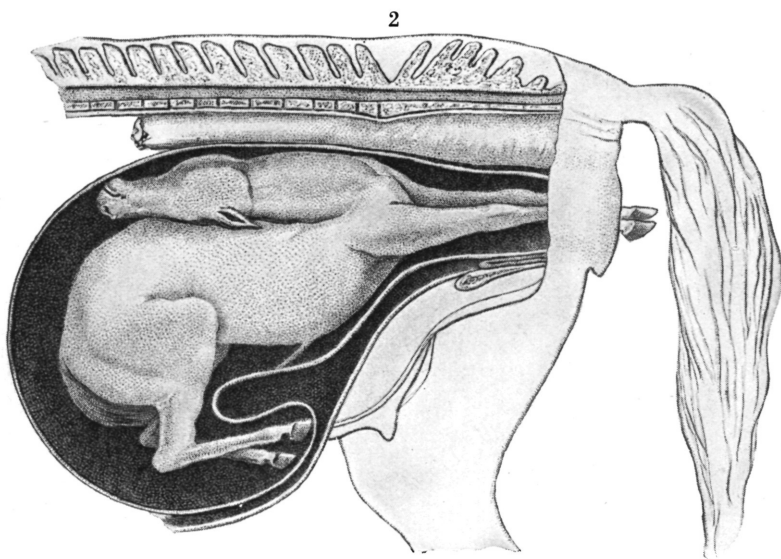
after Fleming

Haines, del.

ABNORMAL PRESENTATIONS.



Anterior presentation. Head turned on side.



Anterior presentation. Head turned on back.

Haines, del.

ABNORMAL PRESENTATIONS.

If the labor has been long in progress and the fetus is jammed into the pelvis, the womb emptied of the waters and firmly contracted on its solid contents, the case is much more difficult. The mare may be anesthetized and turned on her back with hind parts elevated, and the womb may be injected with oil. Then, if the ear can be reached, the correction of the malpresentation may be attempted as previously described. Should this fail, one or more sharp hooks may be inserted in the neck of the foal as near the head as can be reached, and ropes or chains attached to these may be pulled on, while the body of the foal is pushed back by the forelegs or by a repeller. Such repulsion is made in a direction obliquely upward toward the loins of the mare, so as to rotate the fetus in such a way as to bring the head up. As this is accomplished a hold may be secured nearer and nearer to the nose, with hand or hook, until the head can be straightened out on the neck.

All means failing, it becomes necessary to remove the forelegs (embryotomy) to make more space for bringing up the head. If, even then, this cannot be accomplished, it may be possible to push the body backward and upward with the repeller until the hind legs are brought to the passage, when they may be noosed and delivery effected with the posterior presentation.

Head turned on shoulders.—In this case the forefeet are presented, and the hand passed along the forelegs in search of the missing head finds the side of the neck turned to one side, the head being perhaps entirely out of reach (pl. XVIII, fig. 1). To bring the head forward it may be desirable to lay the mare on the side opposite to that to which the head is turned, and she may be anesthetized. Then the feet being noosed, the body of the fetus is pushed, by the hand or repeller, forward and to the side opposite to that occupied by the head until the head comes within reach, near the entrance of the pelvis. If such displacement of the fetus is difficult, it may be facilitated by a free use of sterile or antiseptic lubricant. When the nose can be seized it can be brought into the passage, as when the head is turned down. If it cannot be reached, the orbit may be seized to draw the head forward until the nose can be grasped or the lower jaw noosed. In very difficult cases a rope may be passed around the neck by the hand or with the aid of a curved carrier (pl. XIV), and traction may be made upon this while the body is being rotated to the other side. In the same way, in bad cases a hook may be fixed in the orbit or even between the bones of the lower jaw to assist in bringing the head up into position. Should all fail, amputation of the forelegs may be resorted to, as advised under the last heading.

Head turned upward on back.—This differs from the last malpresentation only in the direction of the head, which has to be sought

above rather than at one side, and is to be secured and brought forward in a similar manner (pl. XVIII, fig. 2). If a rope can be passed around the neck it will be most effectual, as it naturally slides nearer the head as the neck is straightened and ends by bringing the head within easy reach.

Hind feet engaged in pelvis.—In this case the forelegs and head are presented naturally, but the hind legs bent forward from the hip and the arched loins allow the hind feet also to enter the passages, and the further labor advances the more firmly does the body of the foal become wedged into the pelvis (pl. XVII, fig. 2). The condition can be recognized by introducing the hand along the belly of the fetus, when the hind feet will be felt advancing. An attempt should at once be made to push them back, one after the other, over the brim of the pelvis. If this is not accomplished, the mare may be turned on her back, head downhill, and the attempt renewed. If it is possible to introduce a straight rope carrier, a noose passed through this may be put on the fetlock and the repulsion thereby made more effective. In case of continued failure the anterior presenting part of the body may be skinned and cut off as far back toward the pelvis as possible (see Embryotomy); then nooses are placed on the hind fetlocks and traction is made upon these while the quarters are pushed back into the womb. Then the remaining portion is brought away by the posterior presentation.

Anterior presentation with back turned to one side.—The diameter of the axis of the foal, like that of the pelvic passages, is from above downward, and when the fetus enters the pelvis with this greatest diameter engaged transversely or in the narrow diameter of the pelvis, parturition is difficult or impossible. In such a case the pasterns and head may be noosed, and the passages and engaged portion of the foal freely treated with a sterile or antiseptic lubricant, the legs may be crossed over each other and the head, and a movement of rotation effected in the fetus until its face and back are turned up toward the croup of the mare; then parturition becomes natural.

Back of foal turned to floor of pelvis.—In a roomy mare this is not an insuperable obstacle to parturition, yet it may seriously impede it, by reason of the curvature of the body of the foal being opposite to that of the passages, and the head and withers being liable to arrest against the border of the pelvis. Rubbing the passage with a sterile or antiseptic lubricant and traction of the legs and head will usually suffice with or without the turning of the mare on her back.

In obstinate cases there are two other resorts: (1) To turn the foal, pushing back the fore parts and bringing up the hind parts to make a posterior presentation, and (2) the amputation of the forelegs after which extraction may be effected.

Posterior presentation with leg bent at hock.—In this form the quarters of the foal with the hind legs bent up beneath them are presented but cannot advance through the pelvis by reason of their bulk (pl. XV, fig. 3). The oiled hand when introduced can feel the outline of the buttocks, with the tail and anus in the center and the sharp points of the hocks beneath. It may be possible to pass a rope around each leg at the hock, then with the hand or repeller the buttocks may be pushed backward and upward, until the feet can be brought up into the passages. To this the great length of the shank and pastern in the foal is a serious obstacle, and in all cases the foot must be shielded in the palm of the hand while being brought up over the brim of the pelvis; otherwise the womb may be torn. When the pains are too violent and constant to allow effective manipulation, some respite may be obtained by the use of chloroform or other anesthetic and by turning the mare on her back, but often the operator fails and the foal must be sacrificed. Two courses are still open: (1) To cut through the cords behind and above the hock and extend the upper part of the leg, leaving the hock bent, and extract in this way, and (2) to amputate the hind legs at the hip joint and remove them separately, after which the body may be extracted.

Posterior presentation with legs bent forward from hip.—This is an aggravated form of the presentation last described (pl. XVII, fig. 1). If the mare is roomy, a rope may be passed around each thigh and the body pushed upward and forward, so as to bring the hocks and heels upward. If this can be accomplished, nooses are placed on the leg farther and farther down until the fetlock is reached and brought into position. If this fails, amputation at the hips is the last resort.

Posterior presentations with back turned sideways or downward.—These are the counterparts of similar anterior presentations and are managed in a like manner.

Presentation of back.—This is rare, yet not unknown, the foal being bent upon itself with the back, recognizable by its sharp row of spines, presented at the entrance of the pelvis and the head and all four feet turned back into the womb (pl. XVI, fig. 1). The body of the fetus may be extended across the opening transversely, so that the head corresponds to one side (right or left), or it may be vertical with the head above or below.

In any such position an attempt is to be made to push the body of the fetus forward and upward or to one side, as may best promise to bring up the fore or hind extremities, and bring the latter into the passage so as to constitute a normal anterior or posterior presentation. This turning of the fetus may be favored by a given position of the mare, by the free use of oil on the surface of the fetus, and by the use of a repeller.

Presentation of breast and abdomen.—This is the reverse of the back presentation, the foal being extended across in front of the pelvic opening, but with the belly turned toward the passages and with all four feet engaged in the passage (pl. XVI, fig. 2). The usual course is to secure the hind feet with nooses and then push the forefeet forward into the womb. As soon as the forefeet are pushed forward clear of the brim of the pelvis, traction is made on the hind feet so as to bring the thighs into the passage and prevent the reentrance of the forelegs. If it proves difficult to push the forelegs back, a noose may be passed around the fetlock of each and the cord drawn through the eye of a rope carrier, by means of which the members may be pushed back.

EMBRYOTOMY

Embryotomy consists in the dissection of the fetus to reduce its bulk and allow its exit through the pelvis. Most embryotomies, when possible, are carried out by operating through an incision in the skin, leaving the remainder of the skin as intact as possible as a protection to the womb during the operation and after the removal of the leg or other part. The operation will vary in different cases according to the necessity for the removal of one or more parts in order to obtain the desired reduction in size. Thus it may be necessary to remove the head and neck, one foreleg or both, one hind leg or both, different parts of the trunk, or superfluous (monstrous) parts. Some of the simpler operations in embryotomy (incision of the head in hydrocephalus, incision of the belly in dropsy) have already been described. This section deals with the more difficult procedures. The technique used in these operations necessarily varies according to each case and the preference of the veterinarian.

Amputation of the head.—This may be indicated when both forelegs are turned back and the head alone has made its exit in part. It is most difficult when the head is still retained in the passages or womb, as in double-headed monsters. The head may be secured by a hook in the lower jaw, in the orbit, or by a halter, and the skin then divided circularly around the lower part of the face or at the front of the ears, according to the amount of head protruding. Then an incision is made backward along the line of the throat, and the skin dissected from the neck as far back as possible. Then the muscles and other soft parts of the neck are cut across, and the bodies of two vertebrae (neck bones) are severed by cutting completely across the cartilage of the joint. The head and detached portion of the neck may now be removed by steady pulling. In a double-headed monster, the whole of the second neck may be removed with the head. When the head has been detached, a rope may be passed through the eyeholes, or through a slit in the skin, and tied firmly around the skin, to be em-

played as a means of traction when the missing legs or the second head have been brought up into position.

Amputation of the hind leg.—This may be required when there are extra hind legs or when the hind legs are bent forward at the hock or hip joint. In the former condition the procedure resembles that for removal of a foreleg, but requires more anatomical knowledge and skill. The pastern being noosed, a circular incision is made through the skin around the fetlock, and a longitudinal one from that up to the groin, and the skin is dissected from the leg as high up as can be reached, over the croup, if possible, or the skin is loosened without the longitudinal incision. Then the muscles around the hip joint and, if possible, the two interarticular ligaments of the joint (pubofemoral and round) are cut through and the leg extracted.

In case the leg is bent forward at the hock, a rope may be passed round that and pulled to bring the point of the hock between the lips of the vulva. The hamstring and the lateral ligaments of the hock are then cut through, and the legs extended by a rope tied round the lower end of the long bone above (tibia). In case it is still necessary to remove the upper part of the leg, the further procedure is as described in the paragraph on amputation of the forelegs.

If the leg is turned forward from the hip and the fetus is so wedged into the passage that turning is impossible, the case is very difficult. Success may be obtained by cutting in on the hip joint and disarticulating it, then dissecting the muscles back from the upper end of the thigh bone. A noose may then be placed around the neck of the bone and pulled on forcibly, while any unduly resisting structures are cut with the knife.

Another technique is to make free incisions round the hip joints of the foal and tear through the muscles when they cannot be cut; then with cords round the pelvic bones and hooks inserted in the openings in the floor of the pelvis, to drag out the pelvic bones; then cords are put around the heads of the thigh bones for extracting them; then after removal of the intestines the body is drawn out by means of the loose skin with the remainder of the hind legs bent forward beneath it.

Another method is to cut into the pelvis of the foal and with a knife separate the pelvic bones from the loins; then after skinning the quarter, draw out the pelvic bones by means of ropes and hooks and along with them the hind legs.

The hind legs having been removed by one or the other of these procedures, the loose skin detached from the pelvis is used as a means of traction and as a covering for sharp angles of the bones that might injure the mare's tissues. In case of a monstrosity with extra hind legs, it may be possible to bring these up into the passage and utilize them for traction.

Amputation of the forelegs.—This may be begun on the fetlock of the leg projecting from the vulva. An embryotomy knife is used. One type of knife consists of a blade with a sharp, slightly hooked point, and one or two rings in the back of the blade large enough to fit on the middle finger, while the blade is protected in the palm of the hand (pl. XIII, fig. 4). Another form has the blade inserted in a mortise in the handle, from which it is pushed out by a movable button when wanted. A noose is placed around the fetlock of the leg to be amputated, the skin cut circularly entirely around the fetlock. Then after skinning the member, proceed by the use of a long spatula specially designed for the purpose, without cutting the skin longitudinally. Some operators make an incision on the inner side of the leg from the fetlock up to the breastbone. Next, the skin of the leg, from the fetlock up to the breastbone on the inner side and as far up on the shoulder blade as possible on the outer side, is dissected. Finally, the muscles attaching the leg to the breastbone are cut through and strong traction is applied on the leg to drag out the whole leg, the shoulder blade included. The shoulder blade is taken with the leg as that furnishes the greatest obstruction to delivery, above all when it is no longer advanced by the extension of the foreleg, but is pressed back to increase the already thickest posterior portion of the chest. The preservation of the skin from the whole leg is advantageous in various ways: It is easier to cut it circularly at the fetlock than at the shoulder; it covers the hand and knife in making the necessary incisions, thus acting as a protection to the womb; and it affords a means of traction on the body after the leg has been removed.

Removal of the abdominal viscera.—In case the belly is unduly large from decomposition, tumors, or otherwise, it may be necessary to lay it open with the knife and cut or tear out the contents.

Removal of the thoracic viscera.—To diminish the bulk of the chest it may be advisable to cut out the breastbone, remove the heart and lungs, and allow the ribs to collapse with the lower free ends overlapping each other.

Dissection of the trunk.—If it becomes necessary to remove other portions of the trunk, the skin is preserved as much as possible so that all manipulations can be made inside this as a protector, and so that it may remain available as a means of exercising traction on the remaining part of the body and as a covering to protect the vaginal walls against injuries from bones while such part is passing.

FLOODING (BLEEDING FROM THE WOMB)

This is rare in the mare, in connection with failure of the womb to contract on itself after parturition, eversion of the womb (casting the withers), or congestion or laceration. If the blood accumulates in

the flaccid womb, the condition may be suspected only by reason of the rapidly advancing weakness, swaying, unsteady gait, hanging head, paleness of the eyes and other mucous membranes, and weak, small, failing pulse. The hand introduced into the womb detects the presence of the blood partly clotted. If the blood escapes by the vulva, the condition is evident.

Cold water or ice may be applied to the loins and external genital organs. The mare should be kept quiet; a dose of pituitrin may be administered. In addition, certain hemostatic preparations may be injected into the vein or under the skin. A blood transfusion may be advisable.

EVERSION OF THE WOMB

If the womb fails to contract after difficult parturition, the after-pains will sometimes lead to the fundus passing into the body of the organ and passing through that and the vagina until the whole inverted organ appears externally and hangs down on the thighs. The result is rapid engorgement and swelling of the organ, impaction of the rectum with feces, and distention of the bladder with urine, all of which conditions seriously interfere with the return of the mass. The replacement of the organ becomes increasingly difficult as time passes. Pending the arrival of the veterinarian, a clean sheet should be held beneath the womb.

In returning the womb it is better that the animal stand than lie down, as the abdomen is more pendent and there is less obstruction to the return. It may be necessary, however, to put hobbles on the hind legs to prevent the mare from kicking. The use of various sedative or anesthetic drugs is of great assistance in replacing the organ. Certain chemicals or ordinary granulated sugar may serve to shrink the engorged organ. All filth, straw, and foreign bodies should be washed from its surface. Then with a broad, elastic, india-rubber band or a long strip of sterile gauze 4 or 5 inches wide, the womb may be wound as tightly as possible, beginning at the extremity of the horn. This serves two purposes: It squeezes out into the general circulation the enormous mass of blood that engorged and enlarged the organ, and it furnishes a strong protective covering for the now delicate, friable organ, through which it may be safely manipulated without danger of laceration. Pressure is exerted on the general mass while those portions next the vulva are gradually pushed in with the hands, or the extreme lowest point (the end of the horn) may be turned within itself and pushed forward into the vagina by the closed fist, the return being assisted by manipulations by the other hand or those of assistants. By either method the manipulations may be made with comparatively perfect safety as long as the organ is closely wrapped in the bandage. Once a portion has been intro-

duced into the vagina the rest usually follows with increasing ease, and the operation may be completed with the hand and arm extended the full length within the womb and moved from point to point to straighten out all parts of the organ and insure that no portion still remains inverted within another portion. Should any such partial inversion be left it will give rise to straining, under the force of which it will gradually increase until the whole mass will be protruded as before. Following complete replacement of the organ, a quantity of a soothing, oily, antiseptic mixture may be injected into the womb. It may be necessary to apply a truss as an effectual mechanical barrier to further escape of the womb through the vulva. The simplest is made with two 1-inch ropes, each about 18 feet long, each doubled and interwoven at the bend, as seen in plate XIV, figure 4. The ring formed by the interlacing of the two ropes is adjusted around the vulva, the two ends of the one rope are carried up on the right and left of the tail and along the spine, being wound around each other in their course, and are finally tied to the upper part of the collar encircling the neck. The remaining two ends, belonging to the other rope, are carried downward and forward between the thighs and thence forward and upward on the sides of the belly and chest to be attached to the right and left sides of the collar. These ropes are drawn tightly enough to keep closely applied to the opening without chafing and will fit still more securely when the mare raises her back to strain. It is desirable to tie the mare short so that she may be unable to lie down for a day or two, and she should be kept in a stall with the hind parts higher than the fore parts. Violent straining may be checked by appropriate sedatives, and any costiveness or diarrhea should be obviated by a suitable laxative or binding diet.

In cases in which the eversion has been neglected and portions of the organ have become gangrenous, amputation of the part, followed by suturing of the sound membranes, may be the last resort. This procedure is rarely successful in the mare. The necessity of such an operation in most cases may be avoided by replacement of the organ as soon as possible after its misplacement is observed.

RUPTURE (LACERATION) OF THE WOMB

This may occur from the feet of the foal during parturition or from ill-directed efforts to assist, but it is especially likely to take place in the everted, congested, and friable organ. The resultant dangers are bleeding from the wound, escape of the bowels through the opening and their fatal injury by the mare's feet or otherwise, and peritonitis from the extension of inflammation from the wound and from the poisonous action of the septic liquids of the womb escaping into the abdominal cavity. The first object is to close the wound, but unless in eversion

of the womb this is practically impossible. In the last-named condition the wound must be carefully and accurately sewed before the womb is returned.

RUPTURE OF THE VAGINA

This is attended with dangers similar to those from rupture of the womb and in addition by the risk of protrusion of the bladder, which appears through the lips of the vulva as a red, pyriform mass. Sometimes such lacerations extend downward into the bladder, and in others upward into the terminal gut (rectum). In still other cases the anus is torn so that it forms one common orifice with the vulva.

Often such cases prove fatal, or at least complete recovery is not attained and urine or feces or both escape freely into the vagina. The simple laceration of the anus is easily sewed, but the ends of the muscular fibers often do not reunite and the control over the lower bowel is never fully reacquired. The successful suturing of the wound communicating with the bladder or the rectum requires unusual skill and care.

BLOOD CLOTS IN THE WALLS OF THE VAGINA

(See the section on Effusion of Blood in the Vaginal Walls, p. 174.)

LAMINITIS (FOUNDER FOLLOWING PARTURITION)

This sometimes follows acute metritis (inflammation of the womb). Its symptoms are similar to those of the common form of founder caused by disorder of the stomach, and treatment should be directed toward the metritis as well as the laminitis.

METRITIS (INFLAMMATION OF THE WOMB)

Inflammations of the womb are the result of bacterial infections, which may be strictly confined to the womb or to other parts of the genital system, or they may be a part of a general septicemic condition (blood poisoning). In the mare, acute metritis is most commonly evident after parturition and is then a part of so-called parturient fever. The same type of infections may cause abortion, and it is probable that both parturient fever and abortion are usually evidences of infections that were present at the time the mare was bred. Parturient fever usually accompanies the retention of all or, more commonly, a small portion of the afterbirth in the end of the horn of the uterus. It usually becomes evident in 24 to 72 hours after foaling. The mare shows distress and loses interest in the colt, has a high temperature, goes off feed, and there is a grayish-yellow or blood-flecked, foul-smelling discharge from the vulva. The mare may become much tucked up in the flank and show stiffness which is often due to laminitis. If the disease progresses, complications such as inflammations of the udder, bladder, vagina, abscess in these and

adjoining tissues, or pneumonia may develop. If the animal survives, a chronic metritis may prevail, thus inducing infection to complicate a succeeding pregnancy, if that is attained. Between pregnancies there may be a constant or intermittent, slight or marked discharge of purulent material or clear fluid from the genital organs. Sometimes these fluids, not being discharged, may collect in the womb, through failure of drainage, thus distending that organ considerably. During this time the mare may neither show heat nor accept the stallion and may not appear, without careful examination, to be ailing. Inflammations in the vagina or the neck of the womb, which in themselves may cause sterility, may infect a normal uterus, but it is more usual that the vagina and cervix become infected from the womb. It is conceivable, however, that the presence of coital exanthema in conjunction with secondary bacterial infection may spread to the entire genital tract. Without doubt, stallions suffering from various infections implant disease in mares that they cover.

Prevention and treatment.—The treatment of metritis depends entirely on the stage of the disease. Prevention is of much greater value than attempts at cure. Hygienic measures should be taken at foaling time and at the time the mare is bred. If either mare or stallion shows any evidence of venereal disease, the animals should not be mated. At foaling, if intervention is necessary to assist in delivery, the operator should be scrupulously clean and all instruments used should be sterile or as nearly so as is possible under the circumstances. One should be sure that all the afterbirth has come away after the birth of the colt. If some portion remains, it is probably evidence of previous infection and the greatest care, therefore, should be taken in its removal and proper treatment administered by a person experienced in treating such cases. At the same time the operator must use every precaution to protect his own health, particularly in the case of very severe, putrid conditions in the uterus.

If, in spite of all precautions, acute metritis is suspected, effort should be made to preserve and support the mare's strength in every way possible. A warm, comfortable stall, with blanketing in cold weather, and plenty of clean, fresh water are to be provided. A veterinarian should be called as early as possible, and before he arrives a quantity of water should be boiled for his use. After the removal of the necrotic piece of membrane, if present, the veterinarian may douche the uterus with a suitable antiseptic fluid, taking great care that none of the solution used is retained, or he may place soothing antiseptic preparations in the womb to be left there. It may be necessary to repeat the treatment to control accumulations of inflammatory fluids and pus in the cavity.

If the mare shows symptoms of laminitis she may be placed in a stream of flowing cold water or stood in a foot bath containing water

and ice. If constipation appears, a purgative should be administered. Stimulants may be prescribed. For chronic infections resulting in the accumulation of clear fluid or purulent material, such treatment as is recommended by the veterinarian should be carried out. In general this consists of local antiseptic treatment, possibly the drainage of uterine abscesses by means of a trocar and the use of tonics in conjunction with regular grooming and other good care. No mare that has had metritis or any venereal infection should be bred without the advice of a person qualified to determine that she is fit to assume pregnancy.

PARTURIENT ECLAMPSIA

This is a condition that sometimes occurs in vigorous, well-matured mares, 6 to 10 days after having foaled. Usually the parturition has appeared to be easy and natural. In rare instances, the disease may appear later than 6 to 10 days after foaling and has been reported even in mares that have not yet foaled. Eclampsia is characterized by a sudden attack of extreme nervousness and spasmodic seizures of the body muscles. The mare is particularly sensitive and there are trembling and twitching of the muscles and a stiffness in the gait. The malady progresses rapidly, and usually in a short time, the mare goes down and cannot regain her feet. In most instances there are periods of quiet, but any undue noise or handling of the animal brings on severe convulsions with hard, tense muscles, rapid breathing, and profuse sweating. The animal usually retains consciousness, and there may be a considerable rise in temperature. The attacks may last only a few hours or may persist for several days before recovery or death of the animal.

After the mare has been on pasture with the foal for several days, eclampsia often appears when she is placed in a stable or put into harness. The attack may be induced by excitement as to the safety of her offspring. Although in some cases both mare and foal prior to the attack appear to be doing nicely, some mares develop a discharge from the vulva and the foal may show a tendency toward diarrhea. The discharge is a common indication of metritis, which is believed by some to induce eclampsia. Other cases of the disease seem to be attributable to a calcium deficiency in the mare's system. The calcium may be lowered by the demands of the foal while developing in the uterus and later by the secretion of milk. Some disturbance of the parathyroid gland, which has a part in the regulation of calcium salts in the body, may have the same effect. Eclampsia must be differentiated from several diseases having similar symptoms, including azoturia, which rarely occurs in animals having unrestricted freedom of a pasture and may be diagnosed by the color of the urine,

tetanus, in which there is usually a history of a recent wound through which the infection gained access to the body, and there is an intense spasm of the jaw muscles (lockjaw); encephalomyelitis or other brain diseases, which usually develop more gradually than eclampsia, and epilepsy, in which there are repeated attacks not connected with pregnancy.

Treatment.—Whenever possible the cause should be discovered. Calcium deficiency may be treated by the administration of extracts made from the parathyroid gland or by solutions of calcium salts that are given into the blood stream by way of a vein. The mare should be kept quiet and made as comfortable as possible by allowing the foal to remain with her, by providing warm, clean, well-bedded quarters and sedatives to control the convulsions. Bleeding from the jugular vein has been advocated by some, but such treatment is not to be generally used since it may unnecessarily weaken the animal and thus do more harm than good.

LEUCORRHEA

This is a white (sometimes chocolate-colored) glutinous, chronic discharge, the result of a continued, subacute inflammation usually of the mucous membrane of the vagina or the womb. It may occur during pregnancy or after parturition. The discharge contains many forms of bacteria, by some of which it is manifestly inoculable on the penis of the stallion, producing ulcers and a discharge on the penis or in the sheath. Such lesions are to be distinguished from those of dourine.

Treatment.—It is desirable to determine the source of the trouble, since leucorrhœa is but a symptom of inflammation. Ulcers in the mucous membrane may be curetted and cauterized with suitable drugs. Chronic inflammations of the vagina may be irrigated with douches of various antiseptic solutions. These are usually repeated two or three times a day until the discharge permanently disappears, when the mare may be bred, if she is otherwise normal.

DISEASES OF THE UDDER AND TEATS

CONGESTION AND INFLAMMATION OF THE UDDER

This is comparatively rare in the mare, though in some cases the udder becomes painfully engorged before parturition, and a doughy swelling, pitting on pressure, extends forward on the lower surface of the abdomen. When this goes on to active inflammation, one or both of the glands become enlarged, hot, tense, and painful; the milk is dried up or replaced by a watery or reddish, serous fluid, which at times becomes fetid; the animal walks lame, loses appetite, and shows

general disorder and fever. The condition may end in recovery, in abscess, induration, or gangrene.

Treatment.—The treatment is simple as long as there is only congestion. Active rubbing with petrolatum or oil, or, better, camphorated oil, and the frequent drawing off of the milk, by the foal or with the hand, will usually bring about a rapid improvement. When active inflammation is present, warm-water applications may be kept up for an hour several times a day. Once or twice a day these may be followed by the application of the camphorated oil. A dose of laxative medicine will assist in reducing fever; one-half ounce of saltpeter daily will serve a similar end.

In case the milk coagulates in the udder and cannot be withdrawn, or when the liquid becomes fetid, a solution of antiseptic dye is sometimes injected into the teat. In this connection it is noted that the mare has three separate ducts opening on the summit of each teat and each must be carefully injected. To draw off the fetid product it may be necessary to use a small milking tube or a spring teat dilator as shown in plate XIV, figures 2 and 3. When pus forms and points externally and cannot find a free escape by the teat, the spot where it fluctuates must be opened freely with the knife and the cavity injected daily with antiseptics. When the gland becomes hard and swollen without pain, it may be rubbed daily with iodine ointment.

TUMORS OF THE UDDER

As the result of inflammation of the udder it may become the seat of an indurated diseased growth, which may continue growing, finally seriously interfering with the movement of the hind legs. If such swellings do not give way in their early stages to treatment by drugs, a true tumor may be present. This requires surgical removal. As the gland is often implicated and has to be removed, such mares cannot in the future suckle their colts and therefore should not be bred.

SORE TEATS, SCABS, CRACKS, WARTS

By the act of suckling, especially in cold weather, the teats are subject to abrasions, cracks, and scabs. As the result of such conditions or independently, warts sometimes grow and prove troublesome. The warts may be clipped off and the wounds burned with a caustic pencil. This is best done before parturition so that healing takes place before suckling begins. Sore teats are to be cared for according to the nature of the cause. Soothing ointments are frequently used.

Diseases of the Nervous System

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ANATOMY AND PHYSIOLOGY OF THE BRAIN AND NERVOUS SYSTEM

The nervous system consists of two sets of organs, peripheral and central, the function of one being to establish a communication between the centers and the different parts of the body, and that of the other to generate nervous force. The whole may be arranged under two divisions: (1) The cerebrospinal system, and (2) the sympathetic or ganglionic system. Each is possessed of its own central and peripheral organs.

In the first, the center is made up of two portions—one large and expanded (the brain) placed in the cranial cavity; the other elongated (spinal cord), continuous with the brain, and lodged in the canal of the vertebral column. The peripheral portion of this system consists of the cerebrospinal nerves, which leave the axis in symmetrical pairs and are distributed to the skin, the voluntary muscles, and the organs.

In the second, the central organ consists of a chain of ganglia, connected by nerve cords, which extends on each side of the spine from the head to the rump. The nerves of this system are distributed to the involuntary muscles, mucous membrane, viscera, and blood vessels.

The two systems have free intercommunication, ganglia being at the junctions.

Two substances, distinguishable by their color, namely, the white or medullary and the gray or cortical substance, enter into the formation of nervous matter. Both are soft, fragile, and easily injured, in consequence of which the principal nervous centers are well protected by bony coverings. The nervous substances present two distinct forms—nerve fibers and nerve cells. An aggregation of nerve cells constitutes a nerve ganglion.

The nerve fibers represent a conducting apparatus and serve to place the central nervous organs in connection with peripheral end organs. The nerve cells, however, besides transmitting impulses, act as physiological centers for automatic, or reflex, movements, and also for the sensory, perceptive, trophic, and secretory functions. A nerve consists of a bundle of tubular fibers, held together by areolar tissue, each fiber of which is enclosed in a sheath—the neurilemma. Nerve

fibers possess no elasticity but are very strong. Divided nerves do not retract.

Nerves are thrown into a state of excitement when stimulated, and are, therefore, said to possess excitable or irritable properties. The stimuli may be applied to, or may act upon, any part of the nerve. Nerves may be paralyzed by continuous pressure being applied. When the nerves divide into branches, there is never any splitting up of their ultimate fibers, nor yet is there ever any coalescing of them; they retain their individuality from their source to their termination.

Nerves conveying impressions to the centers are termed sensory, or centripetal, and those transmitting stimuli from the centers to organs of motion are termed motor, or centrifugal. The function of the nervous system, therefore, may be defined in the simplest terms, as follows: It is intended to associate the different parts of the body in such a manner that stimulus applied to one organ may excite or depress the activity of another.

The brain is that portion of the cerebrospinal axis within the cranium, which may be divided into four parts—the medulla oblongata, the cerebellum, the pons Varolii, and the cerebrum—and it is covered by three membranes, called the meninges. The outer of these membranes, the dura mater, is a thick, white, fibrous membrane that lines the cavity of the cranium, forming the internal periosteum of the bones; it is continuous with the spinal cord to the extremity of the canal. The second, the arachnoid, is a delicate serous membrane and loosely envelops the brain and spinal cord; it forms two layers, having between them the arachnoid space that contains the cerebrospinal fluid, the use of which is to protect the spinal cord and brain from pressure. The third, or inner, the pia mater, closely adheres to the entire surface of the brain but is much thinner and more vascular than when it reaches the spinal cord, which it also envelops, and is continued to form the sheaths of the spinal nerves.

The medulla oblongata is the prolongation of the spinal cord, extending to the pons Varolii. This portion of the brain is very large in the horse. It is pyramidal in shape, the narrowest part joining the cord.

The pons Varolii is the transverse projection on the base of the brain, between the medulla oblongata and the peduncles of the cerebrum.

The cerebellum is lodged in the posterior part of the cranial cavity, immediately above the medulla oblongata; it is globular or elliptical in shape, the transverse diameter being greatest. The body of the cerebellum is composed of gray matter externally and of white matter in the center. The cerebellum has the function of coordinating movements, that is, of so associating them as to cause them to accomplish a definite purpose. Injuries to the cerebellum

cause disturbances of the equilibrium but do not interfere with the will power or intelligence.

The cerebrum, or brain proper, occupies the anterior portion of the cranial cavity. It is ovoid in shape, with an irregular, flattened base, and consists of lateral halves or hemispheres. The greater part of the cerebrum is composed of white matter. The hemispheres of the cerebrum are usually said to be the seat of all psychic activities. Only when they are intact are the processes of feeling, thinking, and willing completely possible. If they are destroyed the organism becomes like a complicated, uncoordinated machine, and its activity is only the expression of the internal and external stimuli that act upon it.

The spinal cord, or spinal marrow, is that part of the cerebro-spinal system that is contained in the spinal canal of the backbone and extends from the medulla oblongata to a short distance behind the loins. It is an irregularly cylindrical structure, composed of two lateral, symmetrical halves. The spinal cord terminates posteriorly in a pointed extremity, which is continued by a mass of nerve trunks, the cauda equinae. A transverse section of the cord reveals that it is composed of white matter externally and of gray matter internally. The spinal cord does not fill the whole spinal canal. The latter contains, besides, a large venous sinus, fatty matter, the membranes of the cord, and the cerebrospinal fluid.

The spinal nerves, 42 or 43 in number, arise each by two roots, a superior or sensory, and an inferior or motor. They are grouped as cervical, thoracic, lumbar, sacral, and caudal, according to their location. The nerves originating from the brain are arranged in 12 pairs, which are named first, second, third, and so on to the twelfth, counting from before backward. They also receive special names, according to their functions or the parts to which they are distributed, as follows:

- | | |
|-----------------------------|-----------------------------|
| 1. Olfactory. | 7. Facial. |
| 2. Optic. | 8. Acoustic or auditory. |
| 3. Oculomotor. | 9. Glossopharyngeal. |
| 4. Trochlear, or pathetic. | 10. Vagus or pneumogastric. |
| 5. Trigeminal or trifacial. | 11. Spinal accessory. |
| 6. Abducent. | 12. Hypoglossal. |

SYMPTOMS OF NERVOUS DISEASES

The fact that many different symptoms are observed in diseases affecting the nervous tissues is due partly to the complexity of the nervous system. Symptoms may be classified as follows:

1. Psychic disturbances, such as excitement (wildness) or depression (lack of spirit).
2. Motor irritation, as shown by spasm, twitching, or trembling of muscles.

3. Paralysis, which may be due to disease of the cerebrum, medulla, pons, spinal cord, or the peripheral nerves.
4. Deranged senses as shown by insensitiveness, sensitiveness or itching of the affected part, or the loss of sight or hearing.
5. Incoordination or ataxia, the loss of ability in the affected animal to control the muscles harmoniously.

INFLAMMATION OF THE BRAIN AND ITS MEMBRANES (ENCEPHALITIS, CEREBRITIS, MENINGITIS)

Inflammation may attack these membranes singly or any one of the anatomical divisions of the nerve matter, or it may invade the whole at once. Practical experience, however, shows that primary inflammation of the dura mater is rare, except in direct mechanical injuries to the head or diseases of the bones of the cranium. Neither is the arachnoid often affected with acute inflammation, except as a secondary result. The pia mater is most commonly the seat of inflammation, acute and subacute, but from its intimate relation with the surface of the brain the latter soon becomes involved in the morbid changes. Practically, inflammation of the pia mater cannot be separated from that of the brain proper. However, inflammation may exist in the center of the great nerve masses—the cerebrum, cerebellum, pons Varolii, or medulla at the base of the brain—without involving the surface. When, therefore, inflammation invades the brain and its enveloping membranes it is properly called encephalitis; when the membranes alone are affected it is called meningitis; and when the brain substance alone is affected it is called cerebritis. Since all the conditions merge into one another and can scarcely be recognized separately during the life of the animal, they are here considered together.

The disease process may be widespread in the brain, when it is referred to as diffuse; or it may be confined to a particular part, in which case it is referred to as localized or circumscribed. Localized encephalitis often takes the form of an abscess.

Causes.—The most common cause of encephalitis in horses and mules in the United States is infection with the virus of encephalomyelitis. In this disease, as in rabies, the spinal cord as well as the brain may be involved. In certain areas and seasons, a common form of encephalitis is that known as toxic encephalitis, sometimes referred to as moldy corn poisoning. These diseases are discussed in following pages of this section. In addition to these more common instances of inflammation of the brain, the condition may occur as a complication in influenza, strangles, pneumonia, metritis, anthrax, glanders, and tuberculosis. In colts, encephalitis and the formation of abscesses in the brain may be a complication of joint or navel ill. Some cases are said to result from the excessive consumption of highly nitrogenous feeds. Injuries,

certain parasites, and tumors are sometimes the cause of the condition. Finally, mineral poisons such as lead, phosphorus, or arsenic compounds may be responsible.

Symptoms.—The diseases here grouped together are accompanied with a variety of symptoms, almost none of which, however, are associated so definitely with a special pathological process as to point unmistakably to a given lesion. Usually the first symptoms are those of mental excitement or depression. Acute encephalitis may be ushered in by an increased sensibility to noises, with more or less nervous excitability, contraction of the pupils of the eyes, and a quick, hard pulse. In very acute attacks these symptoms, however, are not always noted. This condition is soon followed by muscular twitchings, convulsive or spasmodic movements, eyes wide open with disturbed vision. The animal becomes afraid to have his head handled. Convulsions and delirium develop, with inability of muscular control, or stupor and coma may supervene. When the membranes are greatly implicated, convulsions and delirium with violence may be expected, but if the brain substances are principally affected, stupor and coma are the prominent symptoms. In the former condition the pulse is quick and hard; in the latter, soft and depressed, with often a dilatation of the pupils, and deep, slow, stertorous breathing. The symptoms may follow one another in rapid succession, and the disease approach a fatal termination within 12 hours. In subacute attacks the symptoms are better defined, and the animal seldom dies before the third day. Within 3 or 4 days gradual improvement may become manifest, or cerebral softening with partial paralysis may occur.

In most cases of encephalitis there is a marked rise in temperature from the very onset of the disease, with a tendency to increase until the most alarming symptoms develop, succeeded by a decrease when coma becomes manifest. The violence and character of the symptoms depend greatly on the extent and location of the structures involved. Thus, in some cases there may be marked paralysis of certain muscles, whereas in others there may be spasmodic rigidity of muscles in a certain region. The animal rarely becomes extremely violent early in the attack, and by rearing up, striking with the forefeet, or falling over, may do great injury to himself, other animals, or attendants. Usually, however, the animal maintains the standing position, propping himself against the manger or wall until he falls from lack of muscular control or from unconsciousness. Occasionally, in his delirium, he may go through a series of automatic movements, such as trotting or walking, and, if loose in a stall, will move around persistently in a circle. Early and persistent constipation of the bowels is a marked symptom in nearly all acute affections of the brain; retention of the urine, also, is frequently observed.

Following these symptoms there are depression, loss of power and consciousness, lack of ability or desire to move, and usually fall of temperature. At this stage the horse stands with legs propped, the head hanging or resting on the manger, the eyes partly closed, and does not respond when spoken to or when struck.

Chronic encephalitis or meningitis may succeed the acute stage, as in blood poison, narcotism, or lead poisoning. This form may not be characterized in its initial stages by excitability, quick and hard pulse, and high fever. The animal usually appears stupid at first and eats slowly; the pupil of the eye does not respond to light quickly; the animal often throws its head up or shakes it as if suffering sudden twinges of pain. The movements are slow or sluggish or there may be partial paralysis of the tongue or throat, one leg, or one side of the face, neck, or body. These symptoms, with some variations, may be present for several days and then subside, or the disease may pass into the acute stage and terminate fatally. Chronic encephalitis may affect an animal for 10 days or 2 weeks without much variation in the symptoms before the crisis is reached. If improvement commences, the symptoms usually disappear in the reverse order to that in which they developed, with the exception of the paralytic effects, which may remain permanently. Paralysis of certain sets of muscles is a common result of chronic, subacute, and acute encephalitis and is due to softening of the brain or to exudation into the cavities of the brain or arachnoid space.

Softening and abscess of the brain are terminations of cerebritis. They may also be due to an insufficient supply of blood as a result of diseased cerebral arteries and of apoplexy. The symptoms are drowsiness, vertigo, or attacks of giddiness, increased timidity, or fear of familiar objects, paralysis of one leg, hemiplegia, imperfect control of the legs, and usually a weak, intermittent pulse. In some cases the symptoms are analogous to those of apoplexy. The character of the symptoms depends on the seat of the softening or abscess within the brain.

Cerebral sclerosis sometimes follows inflammation in the structure of the brain and affects the connective tissues, which eventually become hypertrophied and press upon nerve cells and fibers, cause their ultimate disappearance, and leave the parts hard and indurated. This condition gives rise to a progressive paralysis and may extend along a certain bundle of fibers into the spinal cord. Complete paralysis almost invariably supervenes, leading to death.

Lesions.—On making post mortem examinations of horses that have died of these diseases, an excessive engorgement of the capillaries and small blood vessels, with correspondingly increased redness and changes in both the contents and the walls of the vessels, may be evi-

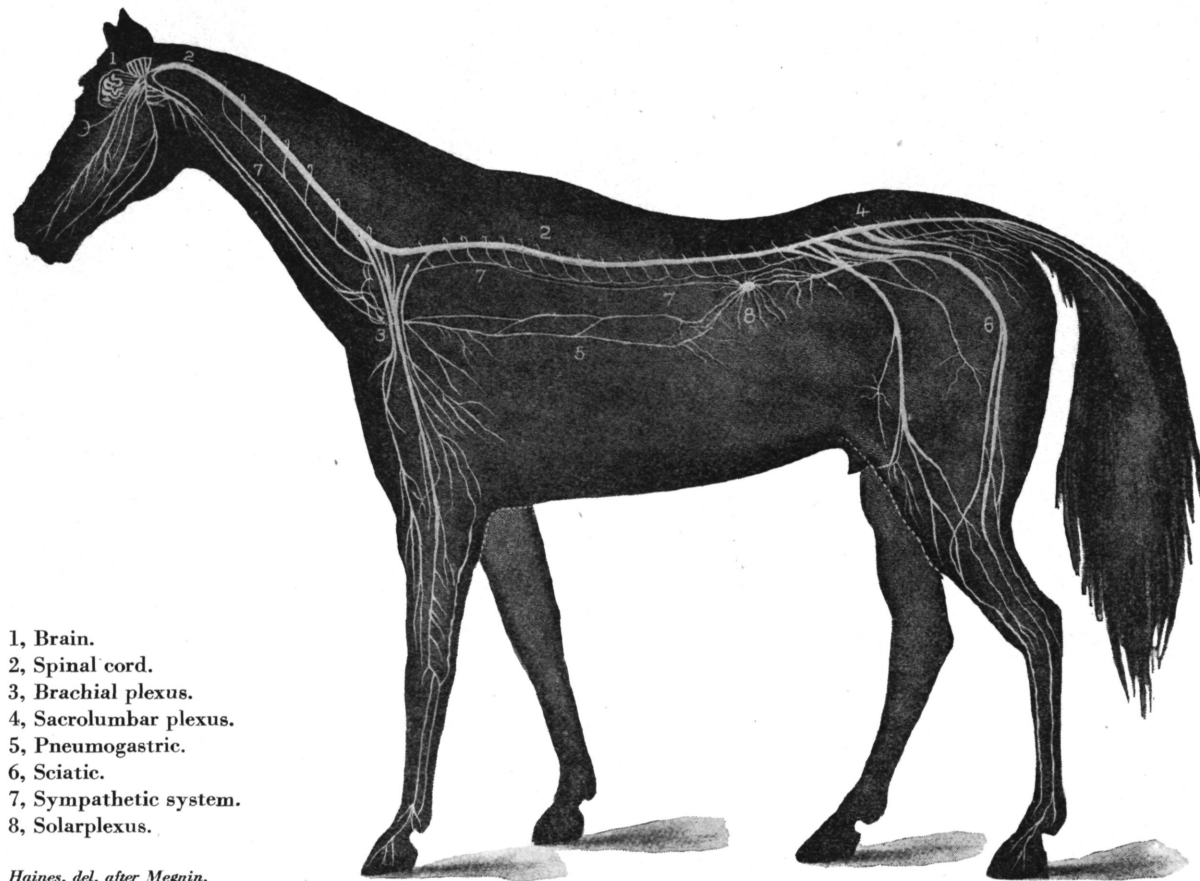
dent. If death has occurred at a later period of the disease, it may be found, depending on the cause, that in addition to the redness and engorgement, an exudation of the contents of the blood vessels into the tissues and upon the surfaces of the inflamed parts has supervened. If the case has been one of encephalitis, there will usually be more or less watery fluid in the ventricles (natural cavities in the brain), in the subarachnoid space, and a serous exudation between the convolutions and interstitial spaces of the gray matter under the membranes of the brain. The quantity and character of fluid vary in different cases. Exudations of a membranous character may be present and are found attached to the surfaces of the pia mater.

In meningitis, especially in chronic cases, in addition to the serous effusion there are changes that may be regarded as characteristic in the formation of a delicate and highly vascular layer or layers of membrane or organized structure on the surface of the dura mater, and also indications of hemorrhages in connection with the membranous formations. Hematoma, or blood tumors, may be found embedded in this membrane. In some cases the hemorrhages are copious, causing paralysis or apoplexy, followed by speedy death. The meningitis may be suppurative. In this case pus is found between the membranes covering the brain.

In cerebritis, or inflammation of the interior of the brain, there is a tendency to softening and suppuration and the formation of abscesses. In some cases the abscesses are small and numerous, surrounded with a softened condition of the brain matter, and sometimes there is one large abscess. In cases of recent development the walls of the abscesses are fringed and ragged and have no lining membrane. In older or chronic cases the walls of the abscesses are generally lined with a strong membrane, often having the appearance of a sac or cyst, and the contents may have a very offensive odor.

In many cases of disease wherein the nervous tissue is involved, microscopic examination of very thinly sliced sections of the tissue is required to demonstrate the pathological condition. Bacteriological examination may be required to determine or exclude the presence of specific germs. If the disease is due to a filtrable virus, this may be generally determined by microscopic examination, but the actual demonstration of the causative virus by means of animal inoculation is usually required for absolute certainty.

Treatment.—The recognition of encephalitis may be easy even to the untrained person, but the determination of the cause and the proper treatment of the condition require the skill and knowledge of a competent veterinarian. If it is possible to determine the cause, this may in some cases be removed or so controlled as to prevent the disease from developing in other horses. Often it is impossible to ascertain



- 1, Brain.
- 2, Spinal cord.
- 3, Brachial plexus.
- 4, Sacrolumbar plexus.
- 5, Pneumogastric.
- 6, Sciatic.
- 7, Sympathetic system.
- 8, Solarplexus.

Haines, del. after Megnin.

THE NERVOUS SYSTEM.*

the cause immediately, and it becomes necessary to treat the case according to the nature and extent of the symptoms shown. Most cases of the disease cannot properly be drenched, owing to the animal's frenzy or stupor or its inability to swallow. Consequently, the animal must be dosed by means of either the stomach tube or rectal injections or sometimes by hypodermic injection.

It is usually desirable to promote elimination by way of the bowels. This may be accomplished by purgatives given hypodermically or by the stomach tube. In addition, repeated injections of quantities of warm, soapy water or water to which a heaping tablespoonful of table salt has been added to each gallon, may be given. If the disease results from poisons or the accumulation of injurious feeds, the stomach may be flushed out by the use of warm water and a stomach tube. Cold water or ice packs may be applied to the head. If the animal is unduly violent, sedatives may be injected into a vein, the stomach, or the rectum. Other cases may require stimulation, which is usually preferably given by means of a hypodermic syringe. Some animals are apparently benefited by the injection, into the blood stream, of solutions of sugar or salt. If the cerebrospinal fluid is greatly increased in quantity, it may in some cases be drawn off in a sterile manner to decrease the pressure within the cranial cavity. In rare instances it may even be advisable to operate to correct a cranial injury or to draw off pus from a formed abscess.

Although the services of a veterinarian are necessary for proper treatment, the attendant's care is of great importance. The animal should be made as comfortable as possible, being kept cool in summer and warm in winter. Unnecessary noise is to be avoided, and if the animal goes down and is unable to rise there should be a thick layer of clean bedding beneath it. In some cases a properly adjusted sling may be used, or the animal may be supported in a specially made padded frame. If there is a desire to eat, only small quantities of laxative feed, such as bran mashes or freshly cut grass, should be allowed. All the cool, clean water that is desired may be supplied in moderate quantities at short intervals. When down, the animal should be turned every few hours from one side to the other. Grooming is as beneficial to a sick horse as is bathing to a sick man and, in most instances, greatly promotes the comfort of the patient. The possibility of recovery depends to a great degree on the extent and nature of the disease process, but as much on the treatment and good care that the animal receives. Often, however, the animal dies. If death occurs, the veterinarian should be given the privilege of performing a post mortem examination, if he so desires, in order that the cause may be determined and other cases prevented, if possible.

CONGESTION OF THE BRAIN

Congestion of the brain consists in an accumulation of blood in the vessels, also called hyperemia, or engorgement. It may be active or passive—active when there is an undue accumulation of blood or diminished arterial resistance, and passive when it accumulates in the vessels of the brain, owing to some obstacle to its return by the veins.

Causes.—The most common cause of congestion of the brain in the horse is an infection, such as encephalomyelitis or rabies. Also poisons, whether bacterial, metabolic, or mineral, are sometimes responsible. The condition occurs in so-called stomach staggers sometimes induced by the feeding of rough, innutritious, or indigestible feeds. Again, teething in young animals or inflammations of the intestines are sometimes causes. The congestion of the brain that occurs under the above-mentioned circumstances, particularly in the case of infections, whether by bacteria or filtrable viruses, usually progresses from congestion to actual inflammation of the nervous tissue and the stage of congestion will only rarely be recognized.

Otherwise active cerebral congestion may result from hypertrophy of the left ventricle of the heart, excessive exertion, the influence of extreme heat (heat stroke), sudden and great excitement, artificial stimulants, and other causes. Passive congestion may be produced by any mechanical obstruction that prevents the proper return of blood through the veins to the heart, such as a small or ill-fitting collar, which often impedes the blood current, tumors or abscesses pressing on the vein in its course, and organic lesions of the heart with regurgitation.

Extremely fat animals with short, thick necks are peculiarly subject to attacks of cerebral congestion. Simple congestion, however, is merely a functional affection and in a slight or moderate degree involves no immediate danger. Extreme engorgement, on the contrary, may be followed by rupture of arteries and capillaries previously weakened by degeneration through infection, by disturbance of the functions controlling blood pressure, or by other causes, and produce immediate death, designated then as a stroke of apoplexy.

Cases of simple congestion are sometimes commonly called vertigo or megrims, which are, strictly speaking, merely symptoms and are therefore not properly used as the names of diseases. It is in this type of case that the following symptoms may be observed.

Symptoms.—Congestion of the brain is usually sudden in its manifestation and of short duration. The animal may stop suddenly and shake its head or stand quietly braced, then stagger, make a plunge, and fall. The eyes are staring, breathing hurried and stertorous, and the nostrils widely dilated. These may be followed by coma, violent convulsive movements, and death. Generally, however,

the animal gains relief in a short time but may remain weak and giddy for several days. If the disease is due to organic change of the heart or disease of the blood vessels in the brain, the symptoms may be of slow development, manifested by drowsiness, dim or imperfect vision, difficulty in voluntary movements, diminished sensibility of the skin, loss of consciousness, delirium, and death. In milder cases effusion may take place in the arachnoid spaces and ventricles of the brain, followed by paralysis and other complications.

Pathology.—In congestion of the brain the cerebral vessels are loaded with blood, the venous sinuses distended to an extreme degree, and the pressure exerted on the brain constitutes actual compression and gives rise to the symptoms just mentioned. On post mortem examination this engorgement is found to be universal throughout the brain and its membranes. This finding serves to distinguish it from inflammations of these structures, in which the engorgements are confined more or less to circumscribed portions. A prolonged congestion, however, may lead to active inflammation, and in that case there are serous and plastic exudations in the cavities of the brain. In addition to the intensely engorged condition of the vessels, the gray matter of the brain is redder than natural. In cases in which several attacks have occurred the blood vessels are often permanently dilated.

Treatment.—The animal should be taken out of harness at once, with prompt removal of all mechanical obstructions to the circulation. If the trouble is caused by venous obstruction by too tight a collar, the loosening of the collar will give immediate relief. To quiet the wild plunging of the animal, sedatives may be given. To revive the animal if it becomes partially or totally unconscious, cold water should be dashed on the head. A purgative may be given if the animal can swallow; otherwise hypodermic medication may be desirable. If the legs are cold, they may be vigorously rubbed at intervals. If symptoms of paralysis remain after 2 or 3 days, protracted treatment may be required. In recurrent cases, treatment may not be advisable, considering the danger to the attendant should an attack occur in close quarters.

Prevention.—This may be accomplished by attention to such points as a well-adjusted collar, with strap running from the collar to the girth to hold down the collar when pulling upgrade; regular feed and exercise, without allowing the animal to become excessively fat and soft; moderate checking, allowing a free-and-easy movement of the head; well-ventilated stable; proper cleanliness; and pure water.

ANEMIA OF THE BRAIN

To a degree anemia is a normal condition when the animal is asleep. It is considered to be a disease or may give rise to disease when the

circulation and blood supply of the brain are interfered with. In some diseases of the heart the brain becomes anemic, and fainting fits occur, with temporary loss of consciousness. Excessive hemorrhage or general anemia due to any cause may induce an anemia of the brain. Tumors growing within the cranium may press upon one or more blood vessels and stop the supply of blood to certain parts of the brain, thus inducing anemia, and ultimately atrophy, softening, or suppuration. Probably the most frequent cause is plugging, or occlusion, of the arteries by a blood clot.

Symptoms.—Imperfect vision, dilated pupils, frequently a feeble and staggering gait, yawning, fainting, and occasionally cramps, convulsions, or epileptiform fits occur.

Pathology.—Pathology of this disease is exactly opposite to that of cerebral hyperemia. The blood vessels are empty, the membranes blanched, and the brain substance softened.

Treatment.—Any restraint to the neck or throat should be removed immediately. Inhalations of amyl nitrite or ammonia may be given. The veterinarian may administer stimulants hypodermically and attempt removal of the cause when this can be determined. General tonics, nutritious feed, rest, and removal from all causes of nervous excitement are recommended.

HEATSTROKE (HEAT EXHAUSTION, SUNSTROKE)

The term "heatstroke" and "sunstroke" are applied to affections occasioned not exclusively by exposure to the sun's rays, as the word "sunstroke" signifies, but by the action of great heat combined generally with humid atmosphere. Exhaustion produced by long-continued heat is often the essential factor and is called heat exhaustion. Horses on the race track undergoing protracted and severe work in hot weather often succumb to heat exhaustion. Draft horses that do not receive proper care in watering, feeding, and rest in shady places and are exposed for many hours to the direct rays of the sun, or that are confined in hot, poorly ventilated stables, frequently have heatstroke. Recent observations indicate that insufficiency of salt is a contributing factor in heatstroke.

Symptoms.—Heatstroke is manifested suddenly. The animal stops, drops its head, begins to stagger, and soon falls to the ground unconscious. The breathing is marked by great stertor, the pulse is very slow and irregular, cold sweats break out in patches on the surface of the body, and the animal often dies without recovering consciousness. The temperature becomes very high, reaching 105° to 109° F.

The animal usually requires urging for some time prior to the appearance of any other symptoms, generally perspiration is checked, and then the horse becomes weak in its gait, the breathing hurried or

panting, eyes watery or bloodshot, nostrils dilated and highly red-dened, assuming a dark, purple color. The pulse is rapid and weak, the heart bounding, followed by unconsciousness. If recovery takes place, convalescence extends over a long period of time, during which incoordination of movement may persist.

Pathology.—Heatstroke is virtually active congestion of the brain, often accompanied with effusion and blood extravasation, often with rapid and fatal lowering of all the vital functions. In many instances death may be due to the complete stagnation in the circulation of the brain, inducing anemia, or want of nourishment of that organ. In other cases it may be directly due to the excessive compression of the nerve matter controlling the heart's action, resulting in paralysis of that organ. There are also changes in the composition of the blood. Actual hemorrhage often occurs in fatal cases, when the condition is known as apoplexy.

Treatment.—The animal should be placed in shaded surroundings. This is one of the few abnormalities in which bleeding may be beneficial. Ice or cold water may be applied to the head and along the spine, and half an ounce of ammonium carbonate or 6 ounces of whisky or other diffusible stimulants may be given in 1 pint of water. Stimulants may be given hypodermically. Cold water may be used as an enema. This should be continued until the temperature is down to 103° F. Brisk friction of the legs and the application of spirits of camphor often yield good results. The administration of the stimulants should be repeated in 1 hour if the pulse has not become stronger and slower. Salt may be given in various ways. Artificial respiration may be advisable. Certain tonics may be given during convalescence.

Prevention.—Recent studies of heatstroke in man have shown, quite conclusively, that individuals having a low content of salt (sodium chloride) in the blood and other tissues are most susceptible to the condition. Extreme heat and exertion deplete the supply of common salt in the body through the medium of perspiration. Heatstroke to a large extent may be prevented in man by a sufficiency of salt in the diet. That the same is true in animals seems entirely logical. Therefore, horses should have salt before them at all times in order that they may maintain the necessary amount of that substance in the body. Salt is, of course, a necessary element of feed for all animals, but it is needed in particularly large quantities in the hot months of the year.

The experienced teamster or any one having to do with the working or shipping of horses in hot weather is particularly attentive to the need of frequent rest periods. In very hot weather horses may have wet sponges or light sunshades on the head when at work, or the head may be sponged with cold water as many times a day as

possible. Feed and water should not be given in excess. During the warm months all stables should be as cool and well ventilated as possible, and if an animal is debilitated from exhaustive work or disease it should receive rest and such treatment as will tend to build up the system. Horses should be permitted to have an abundance of water but they should drink only moderate quantities at a time while they are at work during hot weather.

An animal that has been affected with heatstroke is likely to have subsequent attacks when exposed to provoking influences.

COMPRESSION OF THE BRAIN

In injuries from direct violence, a piece of broken bone may press upon the brain, and, according to the size of the bone, the brain is robbed of its normal space within the cranium. Compression of the brain may also be due to an extravasation of blood or to exudation in the subdural or arachnoid spaces. Death from active cerebral congestion results through compression. The occurrence may sometimes be traced to the direct cause, which will give assurance for the correct diagnosis.

Symptoms.—These are impairment of all the special senses and localized paralysis. All the symptoms of lessened functional activity of the brain are manifested to some degree. The paralysis is a guide for the location of the cause, as this occurs on the opposite side of the body from the location of the injury, and the parts suffering paralysis may clearly point to the part of the brain that is suffering compression.

Treatment.—Trephining, by a skillful operator, for the removal of the cause when due to depressed bone or the presence of foreign bodies may be undertaken in some instances. When the symptoms of compression follow other acute diseases of the brain, apoplectic fits, etc., the treatment must be such as the exigencies of the case demand.

CONCUSSION OF THE BRAIN

This is generally caused by falling over backward and striking the head, perhaps falling forward on the nose, or by a blow on the head. Accidents during shipping, in the chase, or on the track, often cause concussion of the brain.

Symptoms.—Concussion of the brain is characterized by giddiness, stupor, insensibility, or loss of muscular power, succeeding immediately upon a blow or severe injury involving the cranium. The animal may rally quickly or not for hours; death may occur on the spot or after a few days. When there is only slight concussion or stunning, the animal soon recovers from the shock. When the concussion is more severe, insensibility may be complete and continue

for a considerable time; the animal lies as if in a deep sleep; the pupils are insensible to light; the pulse fluttering or feeble; the surface of the body cold, muscles relaxed, and the breathing scarcely perceptible. After a variable interval partial recovery may take place, which is marked by paralysis of some parts of the body, often of a leg, the lips, or the ear. Convalescence is often tedious, and frequently permanent impairment of some organs remains.

Pathology.—Concussion produces laceration of the brain or at least a jarring of the nervous elements, which, if not sufficiently severe to produce sudden death, may lead to softening or inflammation, with their respective symptoms of functional derangement.

Treatment.—Absolute quiet is necessary. The first object in treatment is to establish reaction or to arouse the feeble and weakening heart. This can often be accomplished by dashing cold water on the head and body of the animal; frequent injections of weak ammonia water, ginger tea, or oil and turpentine may be given per rectum, pending the veterinarian's arrival. In most cases this will soon bring the horse to a state of consciousness. As soon as the animal gains partial consciousness stimulants may be given. Owing to severity of the structural injury to the brain or the possible rupture of blood vessels and blood extravasation, the reaction may often be followed by encephalitis or cerebritis and will then have to be treated accordingly. Stimulants should not be administered too freely, and they must be stopped as soon as reaction is established. There is no need for further treatment unless complications develop as a secondary result. Bleeding, which has been so often practiced, is almost invariably fatal in this form of brain affection. Furthermore, it is never safe to drench a horse with large quantities of medicine when the animal is unconscious, for it is likely to draw the medicine into the lungs in inspiration. This frequently causes death sooner or later.

Prevention.—Young horses, when harnessed or bitted for the first few times, should not have their heads checked high, for it frequently causes them to rear up, and, being unable to control their balance, they are likely to fall over sideways or backwards, thus causing brain concussion when they strike the ground. Horses suffering from delirium or acute pain from any cause should be so handled as to prevent such accidents as far as possible.

APOPLEXY OR CEREBRAL HEMORRHAGE

Apoplexy is often confounded with cerebral congestion, but true apoplexy always consists in rupture of cerebral blood vessels, with blood extravasation and formation of blood clot. It is not so common in horses as in cattle.

Causes.—Two causes are involved in the production of apoplexy, the predisposing and the exciting. The predisposing cause is degeneration of the blood vessels.

eration, or disease that weakens the blood vessels; the exciting cause is any one that tends to induce cerebral congestion. Apoplexy is not uncommon in such blood diseases as anthrax and purpura hemorrhagica.

Symptoms.—The disease is characterized by a sudden loss of sensation and motion, profound coma, and stertorous, difficult breathing. The action of the heart is little disturbed at first but soon becomes slower, then quicker and feebler, and after a little time ceases. If the rupture is one of a small artery and the extravasation limited, sudden paralysis of some part of the body may result. The extent and location of the paralysis depend on the part of the brain that is functionally deranged by the pressure of the extravasated blood; hence these conditions are variable.

The absence of any premonitory symptoms or an increase of temperature in the early stage of the attack will usually suffice to distinguish this disease from congestion of the brain, heatstroke, or infectious encephalitis.

Pathology.—In apoplexy there is generally an arteriosclerotic or atheromatous condition of the cerebral vessels with weakening and degeneration of their walls. The rupture of a large artery is usually followed by immediate death, and large rents may be found in the cerebrum, with great destruction of brain tissue, induced by the forcible pressure of the liberated blood. In small extravasations producing local paralysis without marked general disturbance the animal may recover after a time; in such cases gradual absorption of the clot takes place. In large clots atrophy of the brain substances may follow, or softening and abscess from want of nutrition may result, making the animal worthless, and ultimately terminating in death.

Treatment.—Place the animal in a quiet, cool place and avoid all stimulating feed. Medicinal interference with stimulants is more likely to be harmful than of benefit except in threatened collapse, but some medicines are considered helpful during convalescence. Since cerebral apoplexy is due to diseased or weakened blood vessels, the animal is subject to subsequent attacks. For this reason treatment is seldom satisfactory.

ELECTRIC SHOCK

Electric shock, from coming in contact with high-tension electric wires, is of rather frequent occurrence and has an effect on the animal system similar to that from a shock from lightning. Two degrees of electric or lightning shock may be observed, one producing temporary contraction of muscles and insensibility from which recovery is possible, the other killing directly by producing insensibility, particularly involving the centers of respiration and heart action in the brain.

Animals killed by a shock from high-tension wires or lightning frequently have a singed or burned line along the course followed by the

current. The animal may have dropped suddenly and feed may be found clenched in the teeth. Bloody foam may be present at the mouth or the anus. The blood is usually dark and the organs are congested. In this connection, attention is called to the fact that anthrax often causes sudden deaths and similar lesions. The spinal cord and brain usually do not show changes that are recognizable by the naked eye. Microscopically, the appearance is variable. In shocks that are not immediately fatal the animal is usually insensible, the respiration slow, labored, or gasping, the pulse slow, feeble, and irregular, and the pupils dilated and insensitive, or they may be contracted and sensitive. The temperature is lowered. There may be a tendency to convulsions or spasms. The predominating symptoms are extreme cardiac and respiratory depression. Injured animals may suffer various forms of paralysis, chiefly in the legs through which the current passed. Stimulating injections per rectum may be useful also in arousing the circulation; for this purpose whisky or ammonia water may be used. The paralysis usually disappears gradually in several days, if the affected part is massaged with a mild stimulating liniment.

UREMIA

In nephritis, or acute albuminuria uremic poisoning may affect the brain. When, from any cause, the functions of the kidneys become impaired or suppressed and urea (a natural product) is no longer eliminated from these organs, causing it to accumulate in the system, uremic poisoning may develop.

Symptoms.—Uremic poisoning is usually preceded by dropsy of the limbs or abdomen; a peculiar, fetid breath is often noticed; then drowsiness, attacks of diarrhea, and general debility ensue. Suddenly extreme stupor or coma develops; the surface of the body becomes cold; the pupils are insensible to light; the pulse slow and intermittent; the breathing labored; there are convulsions; and death supervenes. The temperature throughout the disease is seldom increased unless the disease becomes complicated with acute, inflammatory disease of the brain or respiratory organs, which often occur as a result of the urea in the circulation. Albumin and tube casts may frequently be found in the urine. The disease almost invariably proves fatal.

Treatment.—This must be directed to a removal of the cause.

INFECTIOUS EQUINE ENCEPHALOMYELITIS (SLEEPING SICKNESS, BRAIN FEVER)

This is an acute, epizootic, infectious disease of horses, mules, and asses, which affects the central nervous system particularly. Not only the brain (encephalon), but the spinal cord (myelon) as well, is affected. The disease has existed for decades in the United States and

during the last 10 years has appeared in epizootic form in many foreign countries in both hemispheres.

It is estimated that no fewer than 1,000,000 cases of the disease have occurred in the United States alone from 1930 to 1940. Since 1935, the Bureau of Animal Industry has compiled information on the incidence of the disease, and it has been reported in some degree in every State except New Hampshire, Pennsylvania, Tennessee, and West Virginia. It is probable that isolated cases have occurred even in these. It is unquestionably the most serious disease with which American veterinarians and farmers have had to contend in recent years.

Cause.—A specific filtrable virus, first demonstrated by Meyer, Haring, and Howitt in California in 1930, is the cause of the disease. Two immunologically distinct types of the virus exist, one known as the western, which occurs chiefly in the West but at least as far east as Alabama and Kentucky; the other known as the eastern, which operates chiefly along the Atlantic seaboard but inland to some degree, in parts of Texas, and probably all along the coast of the Gulf of Mexico. In some outbreaks, both types of virus have been found. One or the other of these same two types of virus have been found in other countries of the Western Hemisphere. In other countries, under different or similar climatological conditions, still other immunologically distinct types of virus have been found. The clinical symptoms of the disease are essentially alike, but the immunity resulting from recovery from one type of infection does not protect against the other.

Distribution and occurrence.—The disease is essentially seasonal as it occurs during the warm months, the incidence usually reaching a peak in late summer or early fall. Outbreaks may begin as early as May or June with sporadic, more or less atypical, cases. The intensity and spread of the disease increases with the advance of the season. In southern areas, the beginning and peak of epizootics frequently occur somewhat earlier than in northern sections. Isolated cases may occur in the winter months in the South during mild seasons.

Pastured animals are more often affected than stabled ones, especially if pasturing is done at night. This is one possible explanation for the comparatively low incidence of the disease in Thoroughbred breeding establishments and Army posts. Farm horses are more often affected than horses in city stables.

Sleeping sickness is most frequent along rivers and streams or in the vicinity of lakes or ponds and in tidewater areas. Low-lying, swampy, poorly drained regions are more often affected. Abnormally wet spring seasons are often followed by great numbers of cases of the disease. Irrigated sections are commonly involved. On the other hand, arid regions may be affected, especially after unusually heavy

rains. The number of cases invariably rises sharply during extremely hot, humid weather, and decreases with cool, dry weather.

The general rate of incidence of the disease varies from less than 1 case per 10,000 horses and mules in some areas to 10 per 100 animals in others. In rare instances as many as 30 cases may occur in each 100 animals. Usually only 1 or 2 cases occur on the average farm, with 2 to 10 animals, and some farms appear to escape the disease altogether. But among the animals on the apparently unaffected premises and those evidently not sick on farms where definite cases have occurred, an undetermined and variable number may become affected with a subclinical or occult form of the disease. Thus the actual rate of attack exceeds the evident rate.

Western-type virus has been demonstrated in each of the following States: Alabama, California, Colorado, Idaho, Illinois, Iowa, Kansas, Kentucky, Minnesota, Montana, Nevada, North Dakota, South Dakota, Texas, and Utah. Eastern-type virus has been identified in Alabama, Delaware, Florida, Georgia, Maryland, Massachusetts, New Jersey, North Carolina, South Carolina, Texas, and Virginia, two of which, Alabama and Texas, have also experienced western-type virus. Virus of as yet undetermined type has been found in Indiana, Louisiana, Nebraska, Ohio, Wisconsin, and possibly Oklahoma. The determination of virus type in the remaining States has not yet been definitely accomplished.

Horses and mules of all ages are susceptible to the disease, although in the years following severe epizootics, the younger animals are more commonly affected. There is considerable evidence that mules are comparatively less susceptible than horses.

How the disease is spread.—Horses and mules, as well as other experimental animals, may be artificially infected by almost any method of inoculation of the virus, and even by feeding under certain conditions.

Kelser in 1933 demonstrated that the disease could be transmitted experimentally by *Aedes aegypti*, a species of mosquito that transmits yellow fever in man. Since this important discovery, at least 10 additional species of mosquitoes of the genus *Aedes* have been found capable of transmitting the disease experimentally, and one species of mosquito, *Culex tarsalis*, has been found naturally infected with western-type equine encephalomyelitis virus.

Ticks (*Dermacentor andersoni* Stiles) have been found capable of transmitting sleeping sickness virus to experimental animals and carrying the virus from one generation to the next through the eggs and larvae.

So-called assassin bugs (*Triatoma sanguisuga*) have been found to contain western-type virus. This bug transmits so-called Chagas, disease, a trypanosomiasis, to man.

All these observations support the epizootiological evidence that infectious equine encephalomyelitis is insect borne. At the present time mosquitoes are considered to be the chief vectors (carriers from one animal to another) of the disease, though other blood-sucking arthropods may be involved. There is no substantial field evidence that the disease is transmitted by contact without the presence of blood-sucking insects or ticks, nor has this ever been observed in many experiments with laboratory animals and horses.

Other susceptible animals.—Infectious encephalomyelitis, once considered to be essentially a disease of equines, is now known to occur in other species. In the laboratory, more than 50 additional species of animals, including birds and wild animals, have been artificially infected. Man is now known to be susceptible, and probably acquires the infection in the same manner as horses. In several instances the disease has been acquired by investigators of the disease in the laboratory, but most of the hundreds of cases now on record have been acquired naturally in regions where the disease was prevalent in horses.

Pigeons, pheasants, prairie chickens, and even deer have been found to be affected. Among the many other species of rodents, birds, ruminants, and other animals proved susceptible to artificial exposure to the disease, there may be still others naturally affected or that harbor the virus though not clinically affected themselves.

Symptoms.—The symptoms, in general, are more or less constant but may vary considerably, and a diagnosis of the disease should depend on an examination by a qualified veterinarian who, in turn, may require laboratory aid for confirmation. Usually there are three distinct phases to the infection whether it be natural or artificially produced.

The first stage may escape the notice of a casual observer, since it consists ordinarily in only a mild indisposition, generally accompanied with a rise in temperature, usually over 102° F. and sometimes as high as 107° F. It is during this stage, particularly, that the virus circulates in the blood and is present in the nasal and possibly other secretions and excretions. The disease may terminate at this stage or proceed to involvement of the central nervous system with serious consequences.

The second stage is characterized by distinct nervous symptoms that may or may not be associated with fever. There may be either complete loss of desire for feed and water or only impairment of ability to seize, masticate, and swallow. When drinking becomes difficult or impossible, water often runs from the nostrils as the animal attempts to swallow. A foul-smelling discharge from the mouth and nostrils may develop as a result of retention of feed in the pharynx and the passage of feed and water through the nasal chambers. Frequently

there is yawning, grinding of the teeth, twitching of the muscles of the lips and jaws, or paralysis of the lips or tongue. Various groups of body muscles may be affected by partial paralysis or twitching. Either an extreme sensitiveness or an impaired sense of feeling of the skin in certain parts or all of the body is common. During this stage the animal may become very drowsy and stupid, the head hanging low in a general attitude of extreme depression. When aroused, the horse may exhibit interest in feed but, after taking this into the mouth, soon grows dull and stands as though dreaming, with the hay or grain remaining unchewed between the lips or in the cheek. In other cases there is a tendency to pull back on the halter or to walk backward if untied. A prominent ridge along the lower part of the abdomen and general gaunt appearance are frequently observed. Some animals walk continuously, usually in one direction, with a swaying, staggy, or stumbling gait. Mares and stallions are said occasionally to display marked sexual excitement. Some animals stand as though fastened to the ground, refusing to be led and being especially incapable of backing. Sometimes the affected animal whinnies and becomes excitable and even unmanageable, lunges about the stall, or butts its head into objects in its path.

In the third and final stage, the horse is unable to stand without support and falls to the ground in a state of collapse. When down, the animal may lie quietly and snore in breathing, or it may make running movements with the legs and beat its head about violently and aimlessly, causing severe bruising. In this stage the temperature is usually only slightly elevated or may be below normal, and the functions of elimination are retarded. There is a rapid loss of weight due to dehydration (loss of water from the tissues) in such cases. When animals reach this stage of the disease, a fatal termination usually follows. Death is probably most often due to paralysis of a vital center in the central nervous system.

In nearly all cases a yellowish discoloration of the membranes of the eye, grinding of the teeth, yawning, staggering gait, and sleepiness are seen at some time during the course of the disease. While not constantly present, such disturbances as the inability to swallow, paralysis of tongue, discharge from the nose, paralysis of the penis, paralysis of the tail, and disturbances of vision are common.

Generally speaking, the disease runs a rapid course, death ensuing in from several hours to a few days after the onset of symptoms. At times the affection assumes a more chronic course, and if the animal does not succumb to pneumonia or other secondary diseases there may be in exceptional cases permanent damage to the brain or spinal cord, causing the so-called dummy or otherwise impaired animal. The recoveries may be as low as 2 percent in some outbreaks and as high as 80 percent in others. Ordinarily the recovered animal is immune to

succeeding exposure to the same type of virus, although rare instances of two or more attacks of the disease occur. Generally, the disease due to eastern-type virus runs a more acute course than that due to western-type virus and the mortality is much higher.

Post mortem appearance.—Post mortem examination reveals little of diagnostic importance since there are few characteristic gross changes in the tissues and organs caused directly by the virus of encephalomyelitis. The various membranes and the white tissues of the body usually are icteric, that is, stained with bile. The liver often is somewhat enlarged and the normal so-called slate color is changed to a yellowish gray. The cerebrospinal fluid is increased in volume and the brain appears moist. Sometimes minute hemorrhages (petechiae) are evident in the brain, particularly in the base of the organ. The mucous membrane of the pharynx and upper air passages may be the seat of an extensive inflammation with evidence of the presence of putrid decomposing feed mixed with the inflammatory exudate. At times pneumonia caused by inhaled feed, medicinal agents, and other foreign material may be found. There is a more or less constant distention of the bladder with thick, sirupy, amber-colored urine; catarrh of the intestines and constipation are usually apparent; the other abdominal organs present no characteristic alterations. In most instances, the subcutaneous tissues and the flesh appear abnormally dry.

The distinctive disease processes occurring in the brain and spinal cord are recognized by microscopic examination. These consist chiefly in varying degrees of degenerative changes in the nerve cells, characteristic cell infiltration producing a cuffing effect about the blood vessels, and further inflammatory cell infiltration into the substance of the brain and cord, sometimes accompanied with hemorrhage. There is evidence of an appreciable degeneration of the liver cells and scattered accumulations of small inflammatory cells like those found in the brain.

Control.—Although not enough is yet known concerning the spread of the disease to permit absolute control, there is sufficient information available to warrant the following measures: Use of equine encephalomyelitis vaccine; separate quarters or spraying; prevention of bites by bloodsucking insects; prompt disposal of dead animals; extermination of rats, mice, and other vermin; nonmovement of equines from affected to clean areas; use of antiencephalomyelitis serum for preventive purposes.

Higbie and Howitt found in 1935 that equine encephalomyelitis virus could be grown in the embryos of incubated hen eggs. This discovery and others led to the development of what is generally believed to be one of the most effective preventive biologic products

available to the veterinarian. The vaccine consists essentially of a suspension of artificially infected embryo tissue in which the virus has been rendered harmless by treatment with a solution of formaldehyde.

Although one dose of the vaccine results in an appreciable degree of resistance, this is effective for only a comparatively short time. Accordingly, two doses of vaccine, at 7- to 10-day intervals, are usually given. Unfortunately, many farmers do not decide to have their animals vaccinated until the disease has already made its appearance on their farms or in their vicinity, under which conditions full effectiveness cannot be obtained. Although vaccination during an outbreak appears to be safe and is effective as a last resort, such a procedure is not so advantageous as vaccination before the epizootic season, which varies somewhat according to locality. In order that the maximum protection against infection during these months may be obtained, it is preferred that the 2-dose vaccination be completed not later than early July in most localities. Experimental tests indicate that most vaccinated animals develop their immunity within 10 days to 2 weeks after the administration of the second dose of vaccine and retain a sufficient degree of immunity to resist even the severest artificial exposure for 6 months and, in some cases, even longer. In order to assure protection it appears, at present, that animals should be vaccinated each spring or early summer. It is necessary that the type of virus operating in a given region be known in order that the proper type of vaccine may be used. Vaccination, properly done, does not interfere with working or breeding the animals.

All animals affected with the disease should be stabled in separate screened quarters or kept thoroughly sprayed with an effective repellent, especially in the early stage of the disease when the blood is infectious. Cases at this stage may be recognized only by temperature readings, other signs of abnormality being indistinct or absent. If possible a separate caretaker should be provided. Although it is probable that man does not contract the disease from horses or other affected animals by direct contact, unnecessary soiling of the hands or person with secretions or excretions from the sick animals should be avoided, and those engaged in handling or treating such animals should avoid unnecessary risks from such a source.

Bites by blood-sucking insects, particularly mosquitoes, which are especially suspected of spreading the disease, should be prevented as far as possible. Any means by which this may be accomplished, either partially or completely, is worthy of consideration. Prevention or control of breeding of the insects, screening of stables, stabling of horses and mules as much as possible, the use of nets or similar protection on working animals, and the frequent application to barn and animals of repellent compounds are beneficial in preventing or limiting bites by possible vectors of the disease.

Animals dead of the disease should be promptly disposed of by thorough rendering, burning, or deep burial with the addition of quicklime. The stables, sheds, corrals, and other quarters used by the affected animals should be thoroughly cleaned. Following cleaning, feed boxes, stalls, watering troughs, and similar equipment should be disinfected with either 2-percent aqueous solution of lye or 1-percent solution of formalin. The formalin will evaporate in time from the treated surfaces, but lye should be thoroughly removed by repeated washing with clean water.

Extermination of rats, mice, and other vermin and the exclusion of unconfined pigeons and other stray or wild animals about the premises are advisable on general principles.

Although rigid general quarantine measures have not been found to be practical in dealing with encephalomyelitis, the movement of horses or mules from an epizootic area into a clean area should be discouraged.

A specific antiencephalomyelitis serum is commercially available and the available experimental data indicate that it has preventive value. Practical considerations, however, considerably confine its use in the prevention of the disease.

A licensed practitioner or veterinary official should be consulted when any of the various phases of control of the disease are considered. In the past much money has been spent by frantic horse owners for worthless and even harmful so-called preventives and cures for infectious encephalomyelitis. These expenditures could be largely avoided by closer relations between horsemen and veterinarians. The use of such nonspecific biological products as influenza bacterin and hemorrhagic septicemia vaccine has no scientific foundation, and expenditures for such preparations as preventives of infectious encephalomyelitis are wasted. Nor are there any drugs or chemicals known to prevent the occurrence of the disease.

Treatment.—Other than the antiencephalomyelitis serum which, if it is to be effective, must be administered very early and in large, repeated doses, there are no specific therapeutic agents known for the treatment of the malady. As has already been suggested in discussing prevention, the use of serum in treatment is a matter for the veterinarian's decision in each case. Such supportive treatment as is indicated by the symptoms and course of the illness in each case should be applied only at the discretion of such a trained advisor. Quiet, cool, comfortable quarters, protection of the animal against possible injury by the use of abundant bedding or slings suspended in a well-padded frame, encouraging the animal to drink fresh water at all times, and supplying small quantities of succulent feed when it will be taken, are advisable. Unnecessary fussing about the animal should be avoided

although when the sick animal is down and unable to rise, it should be turned from side to side several times a day. A genuinely sympathetic and constantly attentive caretaker can do a great deal to assist the veterinarian in treatment and other control measures. Unguided home treatment, such as promiscuous drenching or other administrations that may be suggested by unqualified advisers, is distinctly discouraged since it usually lessens the animal's chance of recovery.

Diagnosis.—The accurate diagnosis of this disease, perhaps more than any other in animals, requires the veterinarian. The history of the case and others in the vicinity are factors to be especially considered. If laboratory confirmation of the clinical diagnosis is required, considerable care and judgment must be exercised in obtaining specimens suitable for the laboratory. If virus is to be sought in the blood, samples must be taken early in the disease, usually even before clear-cut nervous symptoms develop. Brain specimens are best taken from animals immediately after death from the disease or from those sacrificed at the height of the disease, and special precautions must be taken to preserve the specimen properly and prevent contamination.

Infectious equine encephalomyelitis is to be differentiated from other forms of encephalitis, from such infectious diseases as anthrax, influenza, swamp fever, rabies, and tetanus, and from various forms of poisoning. The poisonous substances in these cases include lead, arsenic, barium, phosphorus, mercury, and selenium. They also include plants such as poison hemlock, ragwort (*Senecio*), locoweed, horsetail, whorled milkweed, and ergot-infested *Paspalum* grass, as well as unripe, sprouted, or rotten potatoes. Heatstroke, electric shock, tumors or abscess of the brain, botulism, azoturia, and so-called toxic hepatogenous icterus may also be confused with infectious equine encephalomyelitis.

Toxic hepatogenous icterus, sometimes called secondary or "X" disease, occasionally appears in areas where infectious encephalomyelitis has previously prevailed, usually about 2 weeks to 2 months after the latter disease subsides. Usually horses affected with this disease have no fever, develop an obstinate constipation and extreme icterus, and become violent, pushing strenuously against objects in their path. It is an extremely acute affection with a high death rate. Although many animals that develop this affliction have been treated earlier with antiencephalomyelitis serum, some of those that have not received the serum also contract the disease, so that the relationship between serum administrations and the seemingly toxemic disease is not definitely known. Studies conducted thus far indicate that the affection is not infectious, but its true nature is not yet definitely known.

TOXIC ENCEPHALITIS (ENCEPHALOMALACIA, MOLDY CORN POISONING)

This is a form of encephalitis that is sometimes seen, a few cases at a time, in various parts of the United States. At other times large numbers of horses are afflicted; for example, it has been estimated that in the winter of 1934-35, 5,000 horses died of the disease in one State alone. The largest number of cases has been reported from the Middle West, where much corn is grown and fed. The disease occurs chiefly during the winter months and is believed to be due to some toxin, or poisonous substance, that develops in moldy, wormy, immature, or otherwise inferior feed, usually corn. During the 1934 corn-growing season, drought prevailed more or less generally in the United States. During the protracted dry period, the corn was much stunted and the crop was heavily infested with worms. In the fall, heavy rains occurred and resulted in the growth of much mold on the fodder and the grain itself. More or less similar circumstances have attended the disease in previous and subsequent outbreaks in the sections where it has been encountered. The scarcity of feed following such drought periods often impels the farmer to use damaged corn or other feeds that under normal circumstances would never be given. Present indications lead to the belief that such feeds are in some way responsible for toxic encephalitis. In experimental feeding tests of suspected corn, conducted by Schwarte, Biester, and Murray, it appeared that the toxin, whatever its nature, is cumulative, as symptoms did not appear in less than a month, even though the corn was fed continuously.

The exact nature of the toxin has not been determined, and whether the actual poison is present in the feed at the time it is eaten or whether it develops after being taken into the animals' bodies is not known. In fact, it is not known absolutely that such a substance is the cause of the disease. Despite the fact that many competent veterinarians have worked on the problem, the exact cause has not been determined. No bacterium has been proved to be the cause and a filtrable virus of the nature of that found in infectious encephalomyelitis has not been found in these cases. The fact remains that most of the sick animals have been fed corn in one form or another either in the stable or in the field.

Symptoms.—As with other forms of encephalitis in the horse, the symptoms are somewhat variable. Also cases of this disease show many symptoms that are similar to those of infectious encephalomyelitis. Veterinarians report three differences that are said to be more or less constant: (1) The yellowish discoloration of the mucous membranes of the eye (icterus) seen in encephalomyelitis is rarely found in toxic encephalitis, (2) there is ordinarily no regularly observed rise in temperature such as is usually found in the course of most cases

of encephalomyelitis; (3) the disease occurs chiefly in the colder months of the year when infectious encephalomyelitis rarely if ever occurs. Otherwise, the two diseases are in many respects similar. Generally speaking, there are three types of the disease: (1) That in which the animal is sleepy, untractable and stupid, which is commonly referred to as the lethargic form; (2) the so-called nervous or excitable type in which the animal becomes violent and generally unmanageable; and (3) the paralytic type in which paralysis in one form or another is the chief symptom noted. The onset may be gradual, in which case the horse may show more or less indication of weakness for several hours before symptoms become marked. Others will become wild and excitable—in some cases to such a degree as to suggest rabies—but without having shown premonitory symptoms. The many forms of the disease are very confusing, and even the veterinarian may be obliged to resort to the laboratory before a definite conclusion as to the nature of the disease can be reached.

Post mortem appearance.—Although in the abdominal organs there are often changes that may be recognized by the trained observer, these, so far as is now known, are not constant and therefore are not referred to here. When the cranium is opened, no great increase in the cerebrospinal fluid is noted. In more than half the cases, an area of softening (encephalomalacia) will be found in one of the cerebral hemispheres. The affected portion may be small or, in some cases, as large as a baseball and is usually attended by more or less hemorrhage. In marked cases the brain tissue is mushy or almost fluid in nature, and the brain tissue will appear to sink in and flatten out as a result. Microscopically, lesions quite different from those of either infectious encephalomyelitis or rabies are found. It is sometimes necessary to make such a microscopic examination before the exact nature of the disease can be determined.

Prevention and treatment.—If, as is now believed, damaged feed, most often corn, is responsible for the disease, it is hardly necessary to advise that such feed should not be used. Most livestock growers wisely prefer to feed only materials of the best quality, and it is only in cases of absolute necessity that moldy, immature, or frozen feeds are used. Even though encephalitis may not result, enteritis, impaction, colic, or similar difficulty often is known to develop if deteriorated feeds are used. If there is no alternative, cattle or hogs may better tolerate the available feed or, if it must be fed to horses, it should be given in small quantities in conjunction with other feed of better quality.

As has been stated in connection with other serious diseases, treatment is essentially a task for the veterinarian. The earlier the animal is seen by a competent veterinarian the better will be the chances for

recovery, and in any event there is no advantage in delay. Just as the specific cause is unknown so is there no specific remedy for the condition. Furthermore, the most advisable treatment may vary considerably in different cases. Ordinarily, the veterinarian makes every effort to hasten evacuation of the bowels, and he may wash out the stomach to remove the accumulated material. In some cases it may be necessary to use sedatives to quiet the horse. In others, stimulants will be preferred. The attendant should comply fully with the veterinarian's instructions, and he may be of material assistance by such simple acts as regularly providing fresh water and grooming.

RABIES (HYDROPHOBIA OR MADNESS)

This disease does not arise spontaneously among horses but is the result of a bite from a rabid animal—generally a dog, cat, or some wild animal. The development of the disease follows the bite usually in 3 weeks to 3 months—rarely in 2 weeks and seldom longer than 3 months.

There is no longer any doubt that rabies is an infectious disease. The infectious agent is generally agreed to be of the nature of a filterable virus. It is found particularly in the nervous system but also in the saliva, where it may appear 2 to 3 days before symptoms develop, and even in the milk of milking animals.

Symptoms.—In some cases the animal will continually rub and bite the locality of the wound inflicted by the rabid animal. This symptom often precedes all others. An early manifestation of the development of this disease may be an increased excitability and viciousness; slight noises or the approach of a person incite the animal to kick, strike, or bite at any near object. Often the horse will bite his own legs or sides, lacerating the flesh and tearing the skin. In other cases the animal viciously bites the manger or feed box, sometimes so violently as to fracture the jaw. Stallions and mares may show sexual excitement, the mare seeming to be in heat and the stallion having erections of the penis and marked sexual desire. The eyes appear staring and bloodshot; the ears are on the alert to catch all sounds; the head is held erect. Generally the bowels become constipated and the animal makes frequent attempts at urination, which is difficult. The furious symptoms appear in paroxysms; at other times the animal may eat and drink, although swallowing usually appears to become increasingly difficult toward the latter stage of the disease and may cause renewed paroxysms. The muscles of the legs or back may be subject to intermittent spasms or spasmodic tremors; finally, the hind legs become paralyzed, breathing is very difficult, and convulsions supervene, followed by death. The pulse and respirations are increased in frequency from the outset of the attack. Rabies may possibly be mistaken for tetanus. In the latter disease there are tonic spasms of the

muscles of the jaws or stiffness of the neck or back early in the attack, and evidence of viciousness is absent.

Diagnosis.—The casual observer may in some cases wrongly believe the disease to be infectious encephalomyelitis, toxic encephalitis, or some other brain disturbance. In most of these diseases there is usually no tendency for the afflicted animal to attack man or other animals, such as is common in certain stages of rabies.

Although the experienced veterinarian seldom confuses these diseases, it is always best in suspected cases to submit the head to a laboratory. If the head must be removed by a person other than the veterinarian, caution to avoid infection with the virus should be observed. Rubber gloves should be worn, and after the head is removed and packed for transport all implements used in its removal should be sterilized. In warm weather the head should be packed in ice to prevent putrefaction. Mail regulations require that it must be packed in a watertight container. Competent veterinarians and public-health officials are able to determine definitely, by laboratory examinations, whether the disease is actually rabies. Certain portions of the brain are stained and examined microscopically. In rabies, the large nerve cells are found to contain distinctively staining, protozoanlike bodies, called Negri bodies after Negri, who first described them.

These bodies are almost invariably found in animals that have been killed after reaching the stage of paralysis or that have died of the disease but may be absent in less advanced cases that have been killed. They are absent in normal horses and, as far as is known, do not occur in the brain in any other disease. In doubtful cases some of the brain tissue may be injected into the brain of rabbits or other laboratory animals, which will develop the disease if it is actually rabies but not otherwise. Rabies in the inoculated animal is recognized by the symptoms, the presence of Negri bodies, and the ability of the brain from the inoculated animal to cause the disease in other animals injected with it. The brains of animals that have been infected with fixed virus after certain preparation are used for the preparation of vaccine for the prevention of rabies in man and animals that have been bitten by a rabid animal.

The diagnosis of rabies is very important in the suppression of the disease, and it permits the institution of treatment of persons or animals that have been bitten or exposed in other ways, but that have not yet shown symptoms. If, by reason of previous positive diagnosis of other cases on the same farm or in the vicinity, it is safely concluded by the veterinarian that the disease is rabies, the affected animal should be promptly killed and the body burned or buried deeply. The stall should be thoroughly cleaned and disinfected to eliminate the possibility that virus from the saliva might get into

scratches, cuts, or other wounds of other animals or stable attendants.

Treatment.—When once the disease develops there is no treatment of any known benefit. Man or beast affected with the disease invariably dies.

Prevention.—If an animal is bitten by a rabid animal or even one suspected by a veterinarian of having rabies, the wound should be cauterized immediately. Usually fuming nitric acid is used for the purpose. This sometimes kills the virus. A series of injections of vaccine prepared from the brain tissue of rabid rabbits often prevents the development of the disease. Not all animals bitten by a dog or other animal having rabies contract the disease. The likelihood that rabies will develop apparently depends, as does the time necessary for the development of the disease, on the location of the bite, the extent of the wound inflicted, and the quantity of virus implanted in the tissues at that time. Animals bitten by rabid dogs or other animals, should receive vaccine according to the advice of the veterinarian.

Although predatory wild animals, such as coyotes, wolves, or skunks, may spread rabies in the United States, the most common source of the disease is the dog. For this reason, every effort to cooperate with local health officers and veterinary officials in the proper control of dogs should be freely given. Ownerless, stray dogs should be dealt with according to State laws or local regulations. Proper quarantine and regulation serve to eradicate rabies and prevent its reappearance. Thus England is free of the disease, and certain areas in Germany and the Territory of Hawaii have accomplished similar results.

TETANUS (LOCKJAW)

Lockjaw, usually resulting from wound infection, is characterized by spasms affecting the muscles of the face, neck, body, and legs and of all muscles supplied by the cerebrospinal nerves. The spasms or muscular contractions are rigid and persistent, yet mixed with occasional more intense contractions of convulsive violence. Although horses are probably more commonly affected than other species, the disease also occurs in swine, cattle, dogs, cats, sheep, goats, and man.

Causes.—This disease is caused by a micro-organism known as *Clostridium tetani* that is often found in the soil, dust, and even the manure of herbivorous animals. This germ grows only in the absence of oxygen and forms spores or seed forms that may live for years under certain conditions. It produces a powerful nerve poison, which causes the symptoms of tetanus. The germ itself multiplies at the point where it is introduced, but its poison is absorbed and carried to all parts of the body, and thus the nervous system is poisoned. Deep wounds infected by this germ are more dangerous than super-

ficial wounds, because in them the germ is more remote from the oxygen of the air. Hence, nail pricks, puncture wounds, and similar injuries are especially dangerous. In most instances the cause of tetanus can be traced to wounds, especially pricks and wounds of the feet or of tendinous structures. It sometimes follows castration, docking, and other surgical operations in which the operator does not use due cleanliness of person and methods, or when the wound is not properly cared for after the operation. It may come on as long as 3 or 4 months after the wound is healed but usually develops within 1 to 3 weeks. Horses with a nervous, excitable disposition and stallions are said to be more subject to the development of tetanus, as the result of wounds, than more docile animals such as geldings. But, geldings seem to be more often affected than mares.

Symptoms.—The attacks may be acute or subacute. In an acute attack the animal usually dies within 4 days. In less acute cases the symptoms may persist to a greater or less extent for 3 to 4 weeks. The first symptoms that attract the attention of the owner are difficulty in chewing and swallowing, an extension of the head, and protrusion over the inner part of the eye of the membrana nictitans, sometimes called the haw. An examination of the mouth will reveal an inability to open the jaws to their full extent, and the endeavor to do so will produce great nervous excitability and increased spasm of the muscles of the jaw and neck. The muscles of the neck and along the spine become rigid and the legs are moved in a stiff manner. The slightest noise or disturbance throws the animal into increased spasm of all the affected muscles. The tail is usually elevated and held immovable; the bowels become constipated early in the attack. The temperature and pulse are not much changed. These symptoms in the acute type become rapidly aggravated until all the muscles are rigid—in a state of tonic spasm—with a continuous tremor running through them; a cold perspiration breaks out on the body; the breathing becomes painful from the spasm of the muscles used in respiration; the jaws are completely set, eyeballs retracted, lips drawn tightly over the teeth, nostrils dilated, and the animal presents a picture of the most extreme agony until death relieves it. The pulse, which at first was not much affected, will become quick and hard, or small and thready when the spasm affects the muscles of the heart. In the subacute cases the jaws may never become “locked;” the nervous excitability and rigidity of the muscles are not so great. Some stiffness of the neck or spine, however, is always manifested in turning; the haw is turned over the eyeball when the nose is elevated. It is not uncommon for owners to continue such animals at their work for several days after the first symptoms have been observed. All the symptoms may gradually increase in severity for 10 days and then gradually diminish under

judicious treatment, or they may reach the stage wherein all the characteristics of acute tetanus become developed. In some cases, however, the muscular cramps are confined almost solely to the head or face, perhaps involving those of the neck. In such cases complete trismus (lockjaw) results, and all the head symptoms are acutely developed. On the contrary, the head is almost exempt in some cases, and the body and legs are perfectly rigid and incapable of movement without the animal's falling.

Tetanus may possibly be confounded with various forms of encephalitis or spinal meningitis, but the character of the spasm-locked jaw, retraction of the eyeballs, the difficulty in swallowing due to spasms of the muscles of the pharynx, and above all, the absence of paralysis usually serve to make the distinction.

Treatment.—The animal should be placed in a box stall as far as possible from other horses. If in a country district, the animal should be put into an outbuilding or shed where the noise of other animals will not reach it; if the place is moderately dark, it is all the better; in fly time it should be covered with a light sheet or mosquito netting. The attendant should be very careful and quiet to prevent all unnecessary excitement and increase of spasm. Tetanus antitoxin appears to be useful as a remedy in some cases, if given in very large quantities early in the disease; otherwise it is useless. A search is made for the wound through which the tetanus bacilli entered. If the wound contains pus, this is evacuated, together with any foreign body, such as a splinter, that may be present. The cavity should be kept open and treated regularly with antiseptic substances according to the nature of the wound. It may even be necessary to anesthetize some animals afflicted with tetanus in order to treat the wound properly, especially if it is in the foot. It is dangerous to attempt to drench animals severely affected with tetanus. Various sedatives and even general anesthesia are sometimes employed to relax the spasms.

As long as the animal can eat, only soft mash and gruels should be offered. All the cool, clean water that is desired should be provided. When the horse cannot eat, nourishment may be provided by nutritive enemata of milk, oatmeal gruel, or sugar solution.

Relaxation of the spasms frequently may be obtained by covering the upper part of the head, the neck, and greater part of the body in woolen blankets kept saturated with very warm water. This treatment may be continued for 6 to 8 hours at a time. It may relax the cramped muscles and give them rest and the animal almost entire freedom from pain, but it must be used every day until the acute spasms have permanently subsided in order to be of any lasting benefit. When recovery begins, slow exercise for a few minutes each

day is advised. However, many affected animals that appear to be improving will have a relapse if exercise is given too soon.

Prevention.—With the development of improved methods in veterinary surgery, tetanus has become more and more rare. Much can be done to prevent the occurrence of the disease if sterile instruments and antiseptics are used in such operations as castrations. The prevention of contamination of all wounds with soil and filth should also be observed. To do so will obviate many cases of tetanus, as well as septicemia.

When a valuable horse has sustained a wound that it is feared may be followed by tetanus, it is well to administer a dose of tetanus antitoxin. This is injected beneath the skin with a hypodermic syringe. A very high degree of protection may in this way be afforded. This antitoxin should be administered by the veterinarian, as soon as possible after the wound occurs.

The use of antitoxin should be a regular part of the judicious treatment of wounds in any section where tetanus is prevalent. In the last few years another biological product has become available for veterinary use. This consists of the toxin of the *Clostridium tetani*, which has been so treated, chemically, that it will no longer produce the disease when injected into a normal animal, but does produce a considerable degree of immunity that lasts for several months. This product of the toxin, known as tetanus toxoid, has a definite place in the prevention of tetanus in areas where the disease is particularly prevalent. It may be safely injected at any time, and the immunity that results is more lasting than that induced by antitoxin. If, however, a wound has already been incurred, there may not be sufficient time for immunity to develop if toxoid is used, and antitoxin is given preference.

HYDROCEPHALUS (DROPSY OF THE BRAIN)

This condition consists in an unnatural collection of fluid about or in the brain. Depending on the location of the fluid, the disease is spoken of as external or internal hydrocephalus.

External hydrocephalus is seen chiefly in young animals, in which it develops before birth. It consists in a collection of fluid under the meninges but outside the brain proper. It is accompanied with an enlargement of the skull, especially in the region of the forehead. The pressure of the fluid may cause the bones to soften. The condition may cause dystocia. If the foal is born alive, it may live for a time but die sooner or later.

Internal hydrocephalus is a disease of mature horses and consists in the accumulation of an excessive quantity of fluid in the cavities or ventricles of the cerebrum. The cause of this accumulation may be a

previous inflammation—encephalomyelitis or toxic encephalitis, for example—or a defect in the circulation of blood through the brain. The condition is most frequent in common, heavy-headed draft horses.

Symptoms.—The symptoms are an expression of dullness and stupidity, and from their nature this disease is sometimes known as dumminess. A horse so afflicted is called a dummy. Among the symptoms are loss of intelligence, stupid expression, and poor memory. The appetite is irregular; the horse may stop chewing with a wisp of hay protruding from the lips; the animal seems to forget that it is there. Unnatural positions are sometimes assumed, the legs being placed in clumsy and unusual attitudes. Such horses are difficult to drive, as they do not respond readily to the word, to pressure of the bit, or to the whip. Gradually the pulse becomes weaker, respiration becomes faster, and the animal loses weight. Occasionally there are periods of great excitement at which times the horse becomes uncontrollable. A horse so afflicted is said to have staggers. The symptoms often become more pronounced in hot weather, and the outlook for recovery is not good.

Treatment is merely palliative. Regular work or exercise and nutritious, easily digested feed, with plenty of fresh water, are recommended. Intensive feeding should not be practiced. The bowels should be kept open by the use of appropriate diet or by the use of small, regular doses of Glauber's salt. Under such conditions a few cases may slowly return to normal.

TUMORS WITHIN THE CRANIUM

Tumors within the cranial cavity and the brain are not common, but when they occur they give rise to a variety of symptoms among which are imperfect control of voluntary movement, local paralysis, convulsions, and stupor. Among those that have been observed are the following:

Osseous tumors are sometimes found growing from the walls of the cranium.

Dentigerous cysts, containing a formation identical to that of a tooth, growing from the temporal bone, sometimes are found lying loose within the cranium.

Calcifications and cholesteatomata of the choroid plexus, occurring as the result of chronic inflammation rather than as neoplasms, are frequently seen on post mortem examinations but seldom give rise to any appreciable symptoms during life. They are found in horses of all ages but mostly in older animals. They are found in one or both of the lateral ventricles or beneath the cerebellum enveloped in the folds of the choroid plexus.

Melanotic tumors may occur in the brain and meninges in the form of small, black nodules, particularly in gray or roan horses.

Angioma, fibroma, epithelioma, lipoma, melanosarcoma, or psammoma may develop within or from the meningeal structures of the brain.

Sarcoma and carcinoma may metastasize from other parts of the body.

Glioma is rarely found in the brain.

Glanders, tuberculosis, or staphylococcosis may result in the formation of granulomata in the brain or its membranes.

Treatment for tumors of the brain of the horse is impracticable in most cases.

SPASMS OR CRAMPS

Spasm is a marked symptom in many diseases of the brain and of the spinal cord. Spasms may result from irritation of the motor nerves or from irritation of any part of the sympathetic nervous system, and they usually indicate an excessive action of the reflex motor centers. Spasms may be induced by various medicinal agents given in poisonous doses or by toxic materials in the circulation, such as nux vomica or its alkaloid, strychnine, lead preparations, or an excess of the urea products. Spasms may be divided into two classes: Tonic spasm, when the cramp is continuous or results in persistent rigidity, as in tetanus; clonic spasm, when the cramp is of short duration or is alternated with relaxations. Spasms may affect involuntary as well as the voluntary muscles, the muscles of the glottis, intestines, and even the heart. They are usually sudden in their development.

Spasm of the glottis.—This is manifested by a strangling respiration, a wheezing noise in the act of inspiration, extreme anxiety, and suffering for want of air. The head is extended, the body profusely perspiring, pulse is very rapid, soon great exhaustion becomes manifest, the mucous membranes become turgid and very dark colored, and the animal thus may suffocate in a short time.

Spasm of the intestines.—(See Cramp Colic, p. 59.)

Spasm of the neck of the bladder.—This may be due to spinal irritation, irritants in the bladder, or a reflex from intestinal irritation and is manifested by frequent but ineffectual attempts to urinate.

Spasm of the diaphragm, or thumps.—Spasmodic contraction of the diaphragm, the principal muscle used in respiration, is generally occasioned by extreme and prolonged speeding on the race track or the hunt, but may in some cases be attributed to digestive disturbances. The severe strain thus put upon this muscle finally induces irritation of the nerves controlling it, and the contractions become very forcible and violent, giving the jerking character known among

horsemen as thumps. This condition may be distinguished from violent beating of the heart by feeling the pulse beat at the angle of the jaw and at the same time watching the jerking movement of the body, when it will be discovered that the two bear no relation to each other. Thumps may persist for only a few minutes or for several days, depending on the cause and the treatment given.

Spasm of the thigh, or cramp of a hind leg.—This is frequently witnessed in horses that stand on sloping plank floors—generally in cold weather—or it may come on soon after severe exercise. It is probably due to an irritation of the nerves of the thigh. In cramps of the hind leg, the limb becomes perfectly rigid and attempts to flex are unsuccessful; the animal stands on the affected leg but is unable to move it; it is unnaturally cold; it does not, however, appear to cause much suffering unless attempts are made to change position. This cramp may last only a few minutes, or it may persist for several days. This condition is often taken for a dislocation of the stifle joint. In the latter the foot is extended backward, and the horse is unable to advance it but drags the leg. An examination of the joint also reveals a change in form. Spasms may affect the eyelids by closure or by retraction. Spasm of the sternomaxillaris muscle has been observed, wherein the animal was unable to close the jaws until the muscle became relaxed.

Treatment of spasms.—An anodyne liniment applied to cramped muscles will usually cause relaxation. This may be used when single external muscles are affected. In spasms of the glottis, inhalation of sulfuric ether may give quick relief. Otherwise, it may be necessary to insert a trachea tube to avoid suffocation. In spasm of the diaphragm, the administration of a sedative and rest will generally bring relief, or if this fails other antispasmodics may be given, sometimes by hypodermic injection. If spasms result from organic disease of the nervous system, this disease should receive such treatment as its character demands. In cramp of the leg, compulsory movement may cause immediate relaxation; therefore the animal may be led out of the stable and forced to run or trot. Sudden, nervous excitement caused by a crack of the whip or smart blow will often bring about immediate relief. Should these fail, anodyne liniment may be used along the inside of the thigh, or an anesthetic may be injected into the affected muscle. In all instances the veterinarian endeavors to determine the cause of the particular spasm so that it may be treated effectively and another attack prevented.

Convulsions.—Although there is no disease of the nervous system that can be properly termed convulsions, it is often such a prominent symptom that a few words on the subject are not out of place. General, irregular muscular contractions of various parts of the

body, with unconsciousness, characterize what are regarded as convulsions, and like ordinary spasms depend on some disease or irritation of the nervous structures, chiefly of the brain. Treatment of convulsions as such is seldom recommended, except in cases of poisoning; in fact, a general convulsion is usually self-limited in its duration. Suspending, as it does, respiratory movements, checking the oxygenation and decarbonization of the blood, the rapid accumulation of carbon dioxide in the blood and the exclusion of oxygen quickly put the blood in a condition to produce the most reliable and speedy sedative effect on the nerve excitability that could be found and consequently furnishes its own remedy so far as the continuance of the convulsive paroxysm is concerned. Whatever treatment is used should be directed toward a removal of the cause of the paroxysms.

CHOREA (ST. VITUS'S DANCE)

Chorea is a condition in which clonic spasms or constant twitchings of voluntary muscles occur. There is no loss of consciousness, and there is seldom any disturbance of sensation in the affected part. Symptoms of chorea have been observed in cases of tumors of the brain but most often are associated with a defective nerve supply resulting from some chronic or obscure debilitating general condition. Such spasms of the muscles of the lips, ears, a foot, a leg, or very rarely of a general nature may be seen in horses.

Stringhalt is by some termed "chorea." This is manifested by a sudden jerking up of one or both hind legs when the animal is walking. This symptom may be very slight in some horses but has a tendency to increase with age. In some, the catching up of the affected leg is violent, and when it is lowered to the ground the motion is equally sudden and forcible, striking the foot to the ground like a pile driver. Very rarely chorea may be found to affect one of the forelegs or the muscles of one side of the neck or the upper part of the neck. Involuntary jerking of the muscles of the hip or thigh is seen occasionally and is termed "shivering" by horsemen.

Chorea is often associated with a nervous disposition and is not so frequent in animals with a sluggish temperament. The involuntary muscular contractions cause no pain and do not appear to produce much exhaustion of the affected muscles, although the jerking may be regular and persistent whenever the animal is in motion.

Treatment.—Mild cases may be checked, and recovery sometimes occurs, but in most cases the ailment becomes progressively worse, resisting every treatment. In general, a good state of general health should be preserved by moderate exercise, nutritious feeds, regular grooming, and similar care. This should be supplemented by such treatment as is advised by the attending veterinarian. Some cases of stringhalt respond to tenotomy.

EPILEPSY (FALLING FITS)

This is a chronic nervous condition in which periodic attacks of unconsciousness occur, being preceded by convulsions. True epilepsy, the result of some organic disease of the brain substance that is generally believed to be hereditary, is a disease distinct from the convulsions that may occur in infections, toxemias, poisoning, and other diseases. Attacks may occur only once or twice a year or they may be of more frequent occurrence.

Symptoms.—No premonitory symptoms precede an epileptic fit. The animal suddenly staggers; the muscles become cramped; the jaws may be spasmodically opened and closed, and the tongue become lacerated between the teeth; the animal foams at the mouth and falls in a spasm. The urine flows involuntarily, and the breathing may be temporarily arrested. The paroxysm soon passes off, and the animal gets on its feet in a few minutes after the return of consciousness.

Treatment.—There is no known cure for the disease. In animals in which the attacks occur at short intervals, a laxative diet of moderate quantity, moderate exercise, and the regular administration of bromides or other sedatives may render the attacks fewer and less severe, but permanent recovery is unlikely. During an attack all restraint should be removed, except that the animal should be prevented from injuring itself. Inhalations of amyl nitrite may quiet the convulsions and dashing cold water on the head may restore consciousness. Since the condition is probably hereditary, no animal affected with epilepsy should be used for breeding purposes.

PARALYSIS

Paralysis is a weakness or cessation of the muscular contraction by a lessening or loss of the conducting power or stimulation of the motor nerves. Paralytic affections are of two kinds, complete and incomplete. The former includes those in which both motion and sensibility are affected; the latter those in which only one or the other is lost or diminished. Paralysis may be general or partial. The latter is divided into hemiplegia and paraplegia. When only a small portion of the body is affected, as the face, a leg, or the tail, it is designated as local paralysis. When the affection extends from the periphery of the center it is termed reflex paralysis.

Causes are varied. Most of the acute affections of the brain and spinal cord may lead to paralysis. Injuries, tumors, disease of the blood vessels of the brain, and similar causes have a tendency to produce suspension of the conducting motive power to the muscular or sensory structures. Pressure upon, or the severing of, a nerve causes a paralysis of the parts to which such a nerve is distributed. Apoplexy may be termed a general paralysis and in nonfatal attacks is a frequent cause of the various forms of paralysis.

GENERAL PARALYSIS

This cannot take place without producing immediate death. The term is, however, usually applied to paralysis of the four extremities, whether any other portions of the body are involved or not. This form of paralysis is due to compression of the brain by congestion of its vessels, large clot formation in apoplexy, concussion, or shock, or any disease in which the whole brain structure is involved in functional disturbance.

HEMIPLEGIA (PARALYSIS OF ONE SIDE OR HALF OF THE BODY)

Hemiplegia is frequently the result of a tumor in the lateral ventricles of the brain, softening of one hemisphere of the cerebrum, pressure from extravasated blood, fracture of the cranium, or it may be due to poisons in the blood or to reflex origin. When hemiplegia is the result of a prior disease of the brain, especially of an inflammatory character, it is seldom complete; it may affect only one leg and one side of the head, neck, or muscles along the back, and may pass off in a few days after the disappearance of all the other evidences of the primary affection. In most cases, however, hemiplegia arises from emboli obstructing one or more blood vessels of the brain, or the rupture of some vessel the wall of which had become weakened by degeneration and the extravasation of blood. Sensibility in most cases is not impaired, but in some there is a loss of sensibility as well as of motion. In some cases the bladder and rectum are involved in the paralysis.

In hemiplegia the attack may be very sudden, and the animal falls, powerless to move one side of the body; one side of the lips will be relaxed; the tongue may hang out on one side of the mouth; the tail curved around sideways; an inability to swallow feed or water may be present; and often the urine dribbles away as fast as it collects in the bladder. Sensibility of the affected side may be entirely lost or only partial; the legs may be cold or unnaturally warm. When the attack is not so severe the animal may be able to maintain the standing position but will have great difficulty in moving the affected side. Such animals may recover from the disability. In the more severe cases, in which there is complete loss of power of movement, recoveries are rare.

PARAPLEGIA (TRANSVERSE PARALYSIS OF THE HIND EXTREMITIES)

Paralysis of the hind extremities is usually due to some injury or inflammation affecting the spinal cord. (See Diseases of the Spinal Cord, page 236, or Myelitis.) It may also be due to a reflex irritation from disease of peripheral nerves or to spinal irritation or congestion caused by blood poisons.

When paraplegia is due to mechanical injury of the spinal cord, from a broken back or spinal hemorrhage, it is generally progressive in its character, although it may be sudden. When it is caused by agents in the blood, it may be intermittent or recurrent.

Paraplegia is not difficult to recognize, for it is characterized by a weakness and imperfect control of the hind legs and tail. The urine usually dribbles away as it is formed and the manure is pushed out, ball by ball, without any voluntary effort, or the passages may cease entirely. When paraplegia is complete, large and ill-conditioned sores soon form on the hips and thighs from chafing and bruising, which have a tendency quickly to weaken the animal and necessitate its destruction.

Locomotor ataxia, or incoordination of movement.—This is characterized by an inability to control properly the movement of the legs. Except when this form of paralysis occurs in the course of infectious disease, the animal usually appears perfectly healthy, but when it is led out of the stall its legs have a wobbly movement and it will stumble or stagger, especially in turning. When paralysis is confined to the hind parts, it may be termed a modified form of paraplegia, but often it affects nearly all the voluntary muscles when they are called into play and must be attributed to some pressure exerted on the brain.

LOCAL PARALYSIS

This is frequently met with in horses. It may affect many parts of the body, even vital organs, and is frequently overlooked in diagnosis.

Paralysis of hearing, of the external ear, of the eyelid; partial paralysis of the heart, organs of respiration, and esophagus; loss of deglutition; palsy of the stomach; paralysis of the anus or the penis—all may be manifested when the lines of nervous impulse are impaired.

Facial paralysis is a common type of local paralysis and is due to impairment of function of the motor nerve of the facial muscles. The cause may be an injury at the base of the brain, compression along the course of the facial nerve after it leaves the medulla oblongata, or a bruise after it spreads out on the great masseter muscle.

The symptoms manifested vary according to whether the condition affects one or both sides of the head. Severe unilateral injury causes loss of use of the ear, which hangs limply, or impairment of the muscles of the eyelids. Common symptoms of facial paralysis are a flaccid condition of the cheek muscles, pendulous lips, inability to grasp the feed, often a slow and weak movement in chewing, and difficulty and slowness in drinking. These are common symptoms of infectious encephalomyelitis or other forms of brain disease.

Laryngismus paralyticus, or roaring.—The paralysis of the left recurrent nerve, associated with atrophy of the muscles of the larynx

supplied by it, results in roaring (p. 90). The paralysis may be caused by (1) various acute or chronic infections such as strangles, pleurisy, and laryngitis; (2) tumors; and (3) certain forms of lead poisoning. In addition, there is believed to be a hereditary influence in some cases.

Paralysis of the rectum and tail.—This is generally the result of a blow or fall on the rump, which causes a fracture of the sacrum and injury to the nerves supplying the tail and part of the rectum and muscles belonging thereto. This fracture in most cases would not be suspected were it not for the loss of motion of the tail. These paralyzes may be seen in the course of various infections of the central nervous system.

Intestinal paralysis.—This form of paralysis is characterized by persistent constipation; frequently the strongest purgatives have no effect whatever on the movement of the bowels. In the absence of symptoms of indigestion or special diseases implicating the intestinal canal, torpor of the bowels must be attributed to deficient innervation. This condition may be due to brain affections or reflex paralysis. Sudden checks of perspiration may induce excessive action of the bowels or paralysis.

Paralysis of the bladder.—This usually affects the neck of the bladder and is characterized by incontinence of urine; which dribbles away as fast as it is secreted. The cause may be of reflex origin, disease of the rectum, tumors growing within the pelvic cavity, injury to the spinal cord, or general infections of the central nervous system.

Paralysis of the Optic Nerve (Amaurosis).—A paralysis of eyesight may occur suddenly from rupture of a blood vessel in the brain, acute local congestion of the brain, the administration of excessive doses of belladonna or its alkaloid atropine. In amaurosis the pupil is dilated to its full extent; the eye looks clear but does not respond to light.

Paralysis of the legs.—This may attend general diseases, in which other parts of the body or more than one leg are affected, or may follow injury or inflammation of a particular nerve in one leg. The following are examples of the latter:

Paralysis of the brachial plexus.—The brachial plexus is that collection of nerves located between the chest wall and the forelegs that is derived from nerves from the spinal cord, and from which the several nerves supplying the forelegs are derived. Injuries to the part resulting from collision, lying for long periods in one position, and similar causes are sometimes responsible for the paralysis.

Paralysis of the suprascapular nerve.—This often results from injury to the nerve that supplies the muscles on the outside of the scapula and often occurs in young draft animals when first broken in,

particularly at the plow. The paralysis results in a so-called shoulder slip in which, because of lack of muscular tone, the shoulder joint is weak. The injury later causes a shrinking of the muscles, constituting what is commonly referred to as a sweeney.

Paralysis of the radial nerve.—This nerve is derived from the brachial plexus and supplies a number of the leg muscles. These muscles are often paralyzed through an injury to the nerve that sometimes accompanies a fracture of the first rib. The result of this paralysis is that the elbow appears to be dropped and the leg has the appearance of being longer than a sound member.

Paralysis of the crural, gluteal, and other muscles of the hind legs.—These conditions lead to shrinking of the muscles supplied by the respective injured nerves, occur at times, but paralysis in the hind leg is less common than in the foreleg.

Progressive bulbar paralysis.—This probably is most commonly of toxic origin, arising through successive involvement of the bulbar nerves. There is a gradual, usually bilateral, paralysis, which results in difficult swallowing, impaired chewing, drooling of saliva, and other symptoms clearly pointing to origin in the bulbar region of the brain.

Treatment for paralysis.—In all paralytic affections there may be anesthesia, or impairment of sensibility, in addition to the loss of motion, or there may be hyperesthesia, or increased sensibility, in connection with the loss of motion. These conditions may require special treatment in addition to that for loss of motion. If hyperesthesia is well marked, local anodynes may be needed to relieve suffering. Warm fomentations or chloroform liniment may allay local pain. If there is marked anesthesia, or loss of sensibility, it may become necessary to secure the animal in such a way that it cannot suffer serious injury from accidents that it is not able to avoid. In the treatment of any form of paralysis, consideration must be given to the cause and its removal attempted if it can be discovered. In cases in which the cause cannot be determined, reliance must be placed solely on a general external and internal treatment. In some cases hot-water cloths will be beneficial. Nutritious but not too bulky feed, good ventilation, clean stabling, moderate exercise if the animal is capable of taking it, and good grooming should be observed in all cases. If the condition does not improve rapidly, professional advice should be obtained.

DISEASES OF THE SPINAL CORD

Strictly speaking, there are a number of diseases involving the spinal cord and its membranes. Thus there is myelitis, an inflammation of the cord itself, and spinal meningitis, an inflammation of the membranes of the spinal cord. Just as these two are rarely encountered alone, so are such conditions as spinal congestion, spinal anemia,

spinal concussion, spinal compression, and spinal hemorrhage, seldom seen without other complicating disturbance of the cord tissue. From the standpoint of symptoms, the most exacting technical examination is necessary to differentiate these many conditions. Indeed, it is often impossible for the veterinarian to distinguish them clinically. They most often occur in combinations and are frequently combined with disease of the brain and its membranes. Therefore, no attempt is made in this discussion to treat them separately.

The present opinion of most veterinarians in the United States is that myelitis probably occurs most frequently in horses in this country as a part of the disease known as infectious encephalomyelitis, in which, of course, the brain as well as the cord is diseased. Probably next in the order of causes for abnormalities of the spinal cord are injuries such as may occur as a result of runaways, collisions, kicks, and blows. Finally, myelitis and spinal meningitis, as well as encephalitis, may develop secondary to some infectious disease such as pneumonia, influenza, or strangles, or as a result of a general intoxication, certain mineral poisons, or tumors of the spine.

Symptoms.—These, of course, are variable, depending on the nature, extent, and location of the lesion. For all practical purposes it may be said that the muscles or organs supplied by the nerves directly emanating from the region of the injury or the lesions resulting from the disease will be affected. However, if the damage is extensive, all muscles supplied by nerves emerging behind this part will be more or less involved. Thus a common symptom of affections of the spinal cord is paralysis of the bladder and rectum with retention of feces and urine. In any disease of the spinal cord there are usually a general stiffness and alteration of gait. The back may be somewhat arched, the skin of the back may be extremely sensitive, and there may be spasms of the muscles of the back, the legs, or certain other parts. Pain is a common symptom. Following these indications, paralysis or paraplegia commonly occurs. In such cases the animal is no longer able to stand. So-called bed sores develop rapidly, and in most horses so affected, death follows within a week.

Treatment.—Since treatment depends on the cause and nature of the spinal injury, these are first to be determined, if possible. Pending the arrival of the veterinarian, the horse should be placed in a roomy, well-bedded, partially darkened stall. In the acute stages, cold water or ice packs may be placed along the spine and the animal should have quiet. To alleviate the pain the veterinarian may give various sedatives. Later, stimulants and tonics may be necessary. Enemas of warm soapy water may be given to assist in evacuation of the rectum, and it may be necessary to draw the urine from the bladder frequently by means of the catheter. If the animal will eat, it may receive small quantities of light, laxative, but nutritious feeds. It should be

groomed regularly and, if down, should be turned frequently from one side to the other. If a fracture of the spine or necrosis of the vertebral bones is found, it is usually best to kill the animal in a humane manner, since recoveries from such damage are rarely made.

SPINAL TUMORS

Within the substance of the cord, glioma or the mixed gliosarcomata are the most common kind of tumors. Tumors may form in the meninges and the vertebrae, being of a fibrous or bony nature, and affect the spinal cord indirectly by compression. In the meninges may be found glioma, cancers, psammoma, fibromata; aneurisms of the spinal arteries have been discovered in the spinal canal.

Symptoms.—Tumors of the spinal canal cause symptoms of spinal irritation or compression of the cord. The gradual and slow development of symptoms of paralysis of one or both hind legs or certain muscles may lead to a suspicion of spinal tumors. The paralysis induced is progressive but not usually marked with atrophy of the muscles or increased sensibility along the spine. When the tumor is within the spinal cord itself the symptoms of myelitis may be present.

Treatment.—As with other tumors, there is no known specific treatment. In valuable animals, various forms of irradiation may be tried. Surgical removal is impractical. Usually the disease progresses steadily until it proves fatal.

PLUMBISM (LEAD POISONING)

This disease is not of so frequent occurrence in horses as in cattle. It may be due to the habitual drinking of water that has been standing in lead pipes, in old paint barrels, or in similar containers. It has been met with in enzootic form near smelting works, where, by the fumes arising from the works, lead in the form of oxide, carbonate, or sulfate was deposited on the grass and herbage that the horses ate. A common source of lead is the lead arsenate used as a spray in gardens and orchards. It may be picked up from sprayed foliage and grass, or from partially emptied cartons or sacks in which the compound is sold, or from containers used in mixing the spray. Paint containing lead may be licked from freshly painted surfaces or paint buckets.

Symptoms.—Lead poisoning produces derangement of the functions of digestion and locomotion, or it may affect the lungs principally. In whatever system of organs the lead is mostly deposited, the symptoms of nervous debility are most manifest. If in the lungs, breathing becomes difficult and the animal gets out of breath very quickly when compelled to run. Roaring, also, is frequently a symptom of lead poisoning. When it affects the stomach, the animal gradually

falls away in flesh, the hair becomes rough, the skin tight, and colicky symptoms develop. When the deposit is principally in the muscles, partial or complete paralysis gradually develops. When large quantities of lead have been absorbed, symptoms resembling epilepsy may result, or coma and delirium develop and prove fatal. In lead poisoning there is seldom any increase in temperature. In many cases of chronic lead poisoning a blue line forms along the gums of the front teeth, and the breath assumes a peculiarly offensive odor. Lead can always be detected in the urine by chemical tests. The intensity of the symptoms and the time before they appear largely depend on the quantity of lead taken into the system at one time. Smaller doses continued over a considerable period are more likely to produce chronic forms of poisoning, with nervous symptoms. In these cases, the following are more or less common: Paralysis of the larynx, resulting in roaring; encephalitis; pneumonia; knuckling over at the fetlock. Large doses of lead at one time are more likely to result in acute poisoning and early death. Such cases often show colic, partial blindness, convulsions, and other symptoms.

Treatment.—The treatment of lead poisoning depends on whether it is of an acute or chronic nature. Recovery from acute poisoning may be assisted by washing out the stomach by means of the stomach tube and administering a purgative dose of Epsom or Glauber's salt (1 to 1½ pounds). Stimulants to combat depression may be advisable.

Chronic poisoning may be relieved to some extent by the administration, in the drinking water or bran mash, of 2 to 4 ounces of Epsom or Glauber's salt daily for long periods. These salts and other compounds are believed to convert the lead compounds into insoluble sulfates and assist in their elimination.

If much muscular weakness or paralysis is present, stimulants may be prescribed. Some cases of roaring in animals suffering from chronic lead poisoning may be rendered serviceable by the insertion of a tube in the trachea. This appliance permits the inhalation of air without its passage through the paralyzed larynx. The veterinarian, if he should advise the use of a trachea tube, will give instructions as to the daily care of animals so handled. In all cases of suspected lead poisoning, all utensils that have entered into the supply of feed or water should be examined for the presence of soluble lead. If it occurs near lead works, gardens, or orchards, great care must be given to the supply of uncontaminated fodder or other feeds.

NEURITIS (INFLAMMATION OF A NERVE)

Inflammation of a nerve may result from many causes, among which are: Bacterial infection, various toxins, mineral poisons, direct injuries, or compression due to injury or disease in surrounding tissues. Polyneuritis, a general neuritis, is believed to be the basis of the

nervous disturbances associated with dourine. Exposure to cold and exhaustion appears to aggravate any neuritic condition. Inflammation of a nerve may result in spasm, trembling, paresis or partial paralysis, increased sensibility, neuralgia (pain in the nerve), or sometimes complete loss of sensation in the parts supplied by the nerve.

Treatment.—If possible, the exact nature of the underlying cause should first be determined. Removal or amelioration of the cause may result in recovery if the process has not gone too far. The treatment varies from sedative to stimulant and from rest to surgery, depending on the circumstances in each case.

NEUROMA (TUMOR OF A NERVE)

Neuroma may result from enlargement of the end of a divided nerve or from fibrous degeneration of a nerve that has been bruised or wounded. It most frequently is found after the operation of neurotomy for foot lameness, and it may appear after the lapse of months or even years. Neuroma usually develops within the sheath of the nerve with or without implicating the nerve fibers. It is oval, running lengthwise with the direction of the nerve.

Symptoms.—Pain of the affected leg or part is manifested, especially after resting awhile, and when pressure is made on the tumor it causes extreme suffering.

Treatment.—This usually consists in surgical removal of the tumor, including part of the nerve above and below the growth. If this is done by a skilled operator, recurrence is rare.

INJURIES TO NERVES

These may consist in wounding, bruising, laceration, stretching, or compression. The symptoms that are produced depend on the extent, seat, and character of the injury. Recovery may quickly take place, or it may lead to neuritis, neuroma, spinal or cerebral irritation, paralysis, and other serious derangements. In all diseases, whether produced by some form of external violence or intrinsic causes, the nerves are necessarily involved, and sometimes it is to a primary injury of them that the principal fault in movement or change of nutrition of a part is due. It is often difficult or impossible to discover that an injury to a nerve has been inflicted, but whenever this is possible it may enable one to remedy that which otherwise would result in permanent evil. Treatments consist in relieving compression, in fomentations, the application of anodyne or stimulant liniments, light or electrotherapy, surgery, and rest.

Diseases of the Heart, Blood Vessels, and Lymphatics

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ANATOMY AND PHYSIOLOGY OF THE HEART AND BLOOD VESSELS

The heart is a hollow, muscular organ, situated a little to the left of the center of the chest. Its impulse is felt on the left side on account of its location and from the rotary movement of the organ in action. It is cone-shaped, with the base upward; the apex points downward, backward, and to the left side. It extends from about the third to the sixth ribs, inclusive. The average weight is about 7 to 8 pounds. In horses used for speed the heart is relatively larger, according to the weight of the animal, than in horses used for slow work. It is suspended from the spine by the large blood vessels and held in position below by the attachment of the pericardium to the sternum. It is enclosed in a sac, the pericardium, which is composed of a dense fibrous membrane lined by a delicate serous membrane, which is reflected over the heart; the inner layer is firmly adherent to the heart, the outer to the fibrous sac, and there is an intervening space, known as the pericardial space, in which a small quantity of serum—a thin translucent liquid—is present constantly.

The heart is divided by a shallow fissure into a right and left side; each of these is again subdivided by a transverse partition into two compartments which communicate. Thus there are four cardiac cavities—the superior, or upper, ones called the auricles; the inferior, or lower, ones the ventricles. These divisions are marked on the outside by grooves, which contain the cardiac blood vessels, and are generally filled with fat.

The right side of the heart may be called the venous side, the left the arterial side, named from the kind of blood that passes through them. The auricles are thin-walled cavities placed at the base and are connected with the great veins—the venae cavae and pulmonary veins—through which they receive blood from all parts of the body. The auricles communicate with the ventricles each by a large aperture, the auriculo-ventricular orifice, which is furnished with a remarkable mechanism of valves, allowing the transmission of blood from the auricles into the ventricles but preventing a reverse course.

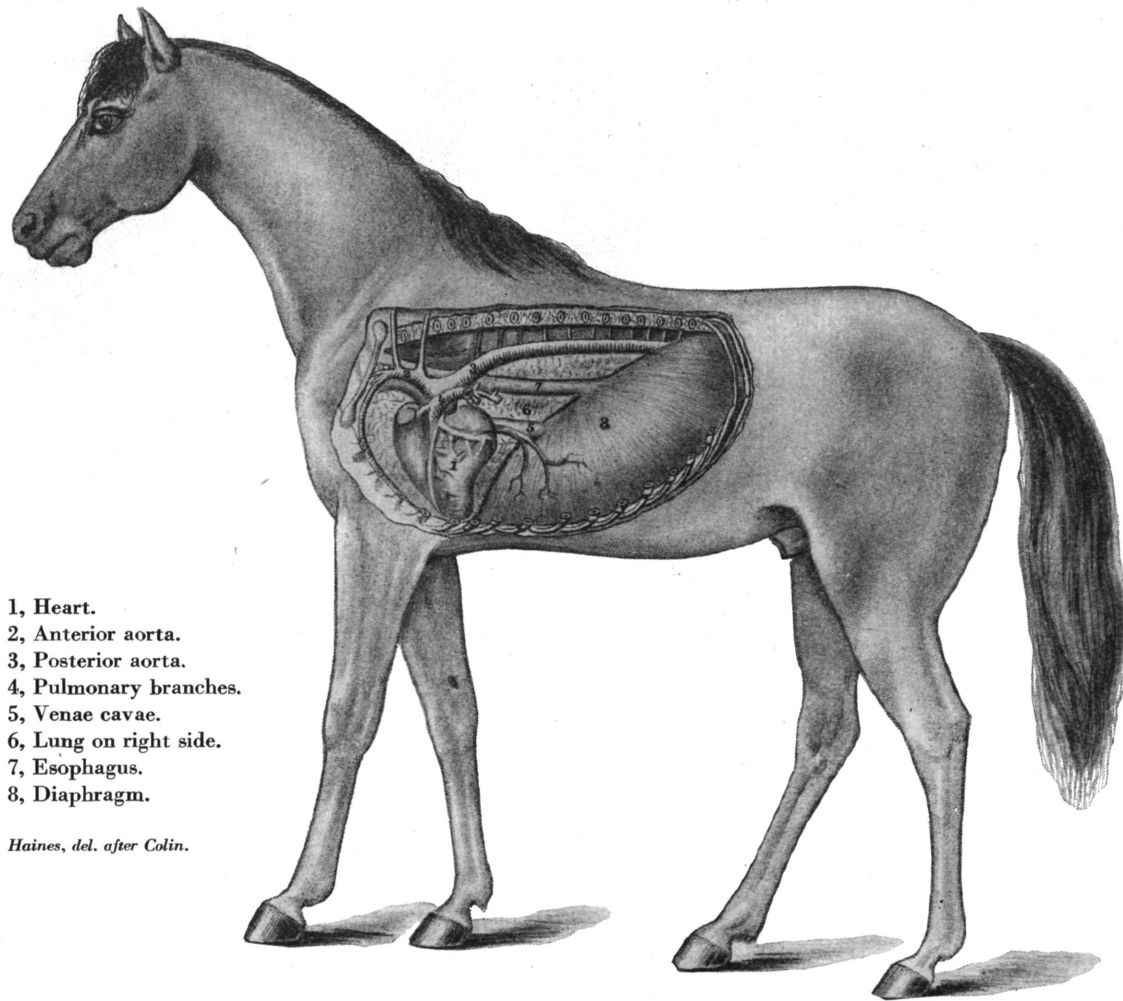
The ventricles are thick-walled cavities, forming the more massive portion of the heart toward the apex. They are separated by a partition and are connected with the great arteries—the pulmonary artery and the aorta—by which they send blood to all parts of the body. At the mouth of the aorta and at the mouth of the pulmonary artery is an arrangement of valves in each case that prevents the reflux of blood into the ventricles. The auriculo-ventricular valve in the left side is composed of two flaps, hence it is called the bicuspid valve; in the right side this valve has three flaps and is called the tricuspid valve. The flaps that form these valves are connected with a tendinous ring between the auricles and ventricles; and each flap of the auriculo-ventricular valves is supplied with tendinous cords, which are attached to the free margin and undersurface, so as to keep the valves tense when closed—a condition that is produced by the shortening of muscular pillars with which the cords are connected. The arterial openings, both on the right and on the left side, are provided with three-flapped semilunar-shaped valves, to prevent the regurgitation of blood when the ventricles contract. The veins emptying into the auricles are not capable of closure, but the posterior vena cava has an imperfect valve at its aperture.

The inner surface of the heart is lined by a serous membrane, the endocardium, which is smooth and firmly adherent to the muscular structure of the heart. This membrane is continuous with the lining membrane of the blood vessels, and it enters into the formation of the valves.

The circulation through the heart is as follows: The venous blood is carried into the right auricle by the anterior and posterior venae cavae. It then passes through the right auriculo-ventricular opening into the right ventricle, thence through the pulmonary artery to the lungs. It returns by the pulmonary veins to the left auricle, then is forced through the auriculo-ventricular opening into the left ventricle, which propels it through the aorta and its branches into the system, the veins returning it again to the heart. The circulation, therefore, is double, the pulmonary, or lesser, being performed by the right side, and the systemic, or greater, by the left side.

As the blood is forced through the heart by contractions of its muscular walls, it has the action of a force pump and gives the impulse at each beat, which is called the pulse—the dilatation of the arteries throughout the system. The contraction of the auricles is quickly followed by that of the ventricles, and then a slight pause occurs; this takes place in regular rhythmical order during health.

The action of the heart is governed and maintained by the pneumogastric nerve (tenth pair of cranial nerves); it is the inhibitory nerve of the heart and regulates, slows, and governs its action. When the



- 1, Heart.
- 2, Anterior aorta.
- 3, Posterior aorta.
- 4, Pulmonary branches.
- 5, Venae cavae.
- 6, Lung on right side.
- 7, Esophagus.
- 8, Diaphragm.

Haines, del. after Colin.

INTERIOR OF CHEST SHOWING POSITION OF HEART AND DIAPHRAGM.

Heart:

Right half, red.

Left half, blue.

Auricles, at upper end.

Ventricles, at lower end.

Arteries, red.

Veins, blue.

1, Left carotid artery.

2, Left jugular vein.

3, Portal system.

4, Vessels of the liver.

5, Arteries of the stomach.

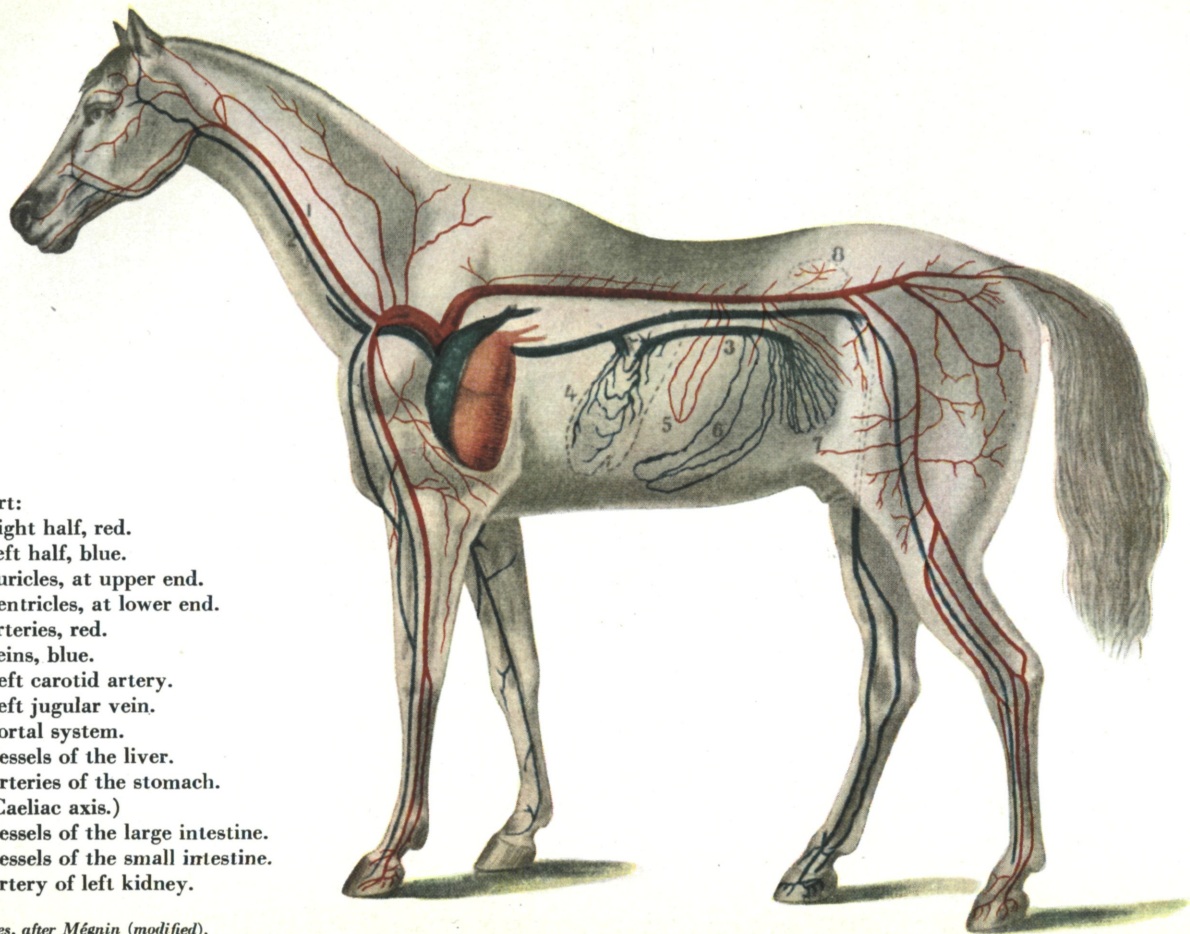
(Celiac axis.)

6, Vessels of the large intestine.

7, Vessels of the small intestine.

8, Artery of left kidney.

Haines, after Ménézin (modified).



CIRCULATORY APPARATUS.

nerve is cut, the heartbeats increase rapidly, and, in fact, the organ works without control. When the nerve is unduly irritated the hold-back, or inhibitory force, is increased, and the heart slows up in the same measure. The left cavities of the heart, the pulmonary veins, and the aorta, or systemic artery, contain red or florid blood, fit to circulate through the body. The right cavities of the heart, with the venae cavae, or systemic veins, and the pulmonary artery, contain dark blood, which must be transmitted through the lungs for renovation.

The arteries, commencing in two great trunks, the aorta and the pulmonary artery, undergo division, as in the branching of a tree.

Their branches mostly come off at acute angles and are commonly of uniform diameter in each case, but successively diminish after and in consequence of division, and in this manner gradually merge into the capillary system of blood vessels. As a general rule, the combined area of the branches is greater than that of the vessels from which they emanate, and hence the collective capacity of the arterial system is greatest at the capillary vessels. The same rule applies to the veins. The effect of the division of the arteries is to make the blood move more slowly along their branches to the capillary vessels, and the effect of the union of the branches of the veins is to accelerate the speed of the blood as it returns from the capillary vessels to the venous trunks.

In the smaller vessels a frequent running together, or anastomosis, occurs. This admits of a free communication between the currents of blood, and must tend to promote equability of distribution and of pressure and to obviate the effects of local interruption. The arteries are highly elastic, being extensile and retractile both in length and breadth. During life they are also contractile, being provided with muscular tissue. When cut across they present, although empty, an open orifice; the veins, on the other hand, collapse.

In most parts of the body the arteries are enclosed in a sheath formed of connective tissue but are connected so loosely that, when the vessel is cut across, its ends readily retract some distance within the sheath. Independently of this sheath, arteries are usually described as being formed of three coats, named, from the relative positions, external, middle, and internal. This applies to their structure so far as it is discernible by the naked eye. The internal, serous, or tunica intima, is the thinnest and is continuous with the lining membrane of the heart. It is made up of two layers—an inner, consisting of a layer of epithelial scales, and an outer, transparent, whitish, highly elastic, and perforated. The middle coat, tunica media, is elastic, dense, and of a yellow color, consisting of nonstriated muscular and elastic fibers, thickest in the largest arteries and

becoming thinner in the smaller. In the smallest vessels it is almost entirely muscular. The external coat, tunica adventitia, is composed mainly of fine and closely woven bundles of white connective tissue, which chiefly run diagonally or obliquely around the vessel. In this coat the nutrient vessels, the vasa vasorum, form a capillary network, from which a few penetrate as far as the muscular coat.

The veins differ from arteries in possessing thinner walls, less elastic and muscular tissue, and for the most part a stronger tunica adventitia. They collapse when cut across or when they are empty. The majority of veins are provided with valves; these are folds of the lining membrane, strengthened by fibrous tissue. They favor the course of the blood and prevent its reflux. The nerves which supply both the arteries and the veins come from the sympathetic system. The smaller arteries terminate in the system of minute vessels known as the capillaries, which are interposed between the termination of the arteries and the commencement of the veins. Their average diameter is about one three-thousandth of an inch.

DISEASES OF THE HEART AND BLOOD VESSELS

In considering diseases of the heart there are many difficulties, depending much on the position that this organ occupies in the animal. The shoulders cover so much of the anterior portion of the chest and often in very heavy-muscled horses the chest walls are so thick that a satisfactory examination of the heart is attended with difficulty. Diseases of the heart are not uncommon among horses; the heart and its membranes are frequently involved in diseases of the respiratory organs, diseases of the kidneys, rheumatism, influenza, etc. Some of the diseases of this organ are never suspected by the ordinary observer during life and are difficult to diagnose with any degree of certainty.

Nervous affections often produce prominent heart symptoms by causing functional disturbance of that organ. If these affections are removed, the heart usually will be restored to perfect vigor and normal action. Organic changes involving the heart or valves, however, usually grow worse and eventually prove fatal. Therefore it is necessary that one know something of the nature and causes of diseases of the heart to form an estimate of the possibilities for recovery or the medicinal treatment to give.

Disease of the heart may occur at any age, but is most frequent in young horses, which, when being trained for fast work, are often subjected to excessive hardship and fatigue. Nervous or timid animals also suffer from such diseases more frequently than those of a sluggish disposition. Any cause which induces a violent or sudden change in the circulation may result in injury to the heart. Symptoms that may frequently denote disease of the heart are difficult breathing or

short windedness, dropsies of the legs, habitual coldness of the extremities, giddiness or fainting attacks, and inability to stand work, although the general appearance would indicate strength and ability.

MYOCARDITIS (INFLAMMATION OF THE MUSCULAR STRUCTURE OF THE HEART)

The heart muscle sometimes becomes inflamed as a complication or result of the existence of general or febrile and of infectious diseases. Severe influenza or infectious pneumonia is frequently followed by myocarditis. By extension of inflammation of the endocardium or pericardium the muscle of the heart may become involved. Over-exertion, especially hard work, continued for a long time may cause this muscle to become inflamed.

Symptoms.—Inflammation of the heart muscle is shown by inability to contract forcibly. This results in a rapid but weak, soft pulse and irregular heart sounds. The pulse may be irregular as a result of the irregular, tumultuous action of the heart. There is great general weakness, shortness of breath, and rapid respiratory movements. In some cases, when the muscle is very much softened and weakened, or perhaps when an abscess forms in the wall of the heart, the course of the disease is very rapid and terminates suddenly from paralysis or rupture of the heart.

Alterations.—The heart muscle has a brownish or yellowish, boiled appearance and is so brittle that it tears easily. There may be a spotted appearance of the muscle from the intense changes in structure in small areas. These small areas may be due to suppuration, in which case they have the characteristics of small abscesses. This last condition is seen in pyemia (blood poisoning). If the disease is of long duration, the fibrous tissue in the wall of the heart may increase to such an extent as to produce an unnatural hardness of the wall.

Treatment.—In this disease the nutrition and strength of the heart should be kept up as much as possible with good feed, good care, and heart tonics and stimulants. The horse should be given such feeds as it will take; it should be kept in an airy box stall; the legs should be well rubbed as often as necessary to keep them warm and bandaged loosely with flannel bandages.

One or more of several drugs may be used internally to help strengthen and support the heart. However, no single drug or combination of drugs can be considered to be appropriate in every case. Depending on the circumstances, such drugs as strychnine, whisky, or digitalis, all of which are more or less dangerous, may be used. The dosage and frequency of administration must vary according to the case, and these are matters on which the untrained person is unqualified to decide.

Artificial Karlsbad salt in heaping tablespoonful doses in the feed may be given in some cases three times daily for a couple of weeks.

Rest is of the greatest importance and should be allowed for a few weeks after recovery seems to be complete.

ENDOCARDITIS (INFLAMMATION OF THE LINING MEMBRANE OF THE HEART)

Endocarditis frequently occurs as a complication of rheumatism, some of the specific or zymotic fevers, specific poisoning, etc. This is a more frequent disease among horses than is generally known and often gives rise to symptoms that at first are obscure and unnoticed.

The heart may become involved in influenza in consequence of the morbid material conveyed through the heart in the blood stream. Many affections in even remote portions of the body may be traced directly to a primary endocardial disease.

Endocarditis may be acute, subacute, or chronic. In acute inflammation there is a thickening and a roughened appearance of the endocardium throughout the cavities of the heart. This condition may be followed by a coagulation of fibrin upon the inflamed surface, which adheres to it, and by attrition soon becomes worked up into shredlike granular elevations. This may lead to a formation of fibrinous clots in the heart and sudden death on the second or third day of the disease.

Subacute endocarditis, which is the most common form, may not become appreciable for several days after its commencement. It is characterized by being confined to one or more anatomical divisions of the heart, and all the successive morbid changes follow each other in a comparatively slow process. Often the only noticeable symptom is distress in breathing, which the disease generally occasions when the animal is exercised, especially if the valves are much involved. When coagula or vegetations form upon the inflamed membrane, either in minute shreds or patches, or when formation of fibrinous clots occurs in the cavity affected, some of these materials may be carried from the cavity of the heart by the blood current into remote organs, constituting emboli that are likely to plug vessels suddenly and thereby interrupt important functions. In the great majority of either acute or subacute grades of endocarditis, whatever the exciting cause, the most alarming symptoms disappear in a week or 10 days, often leaving, however, such changes in the interior lining or valvular structures as to cause impairment in the circulation for a much longer period of time. These changes usually consist of thickening or induration of the inflamed structures. But although the effects of the inflammation in the membrane lining the walls of the ventricles may subside to such a degree as to cause little or no inconvenience, or even wholly disappear, yet after the valvular structures have been involved, causing them to be thicker, less flexible than normal, they

usually remain, obstructing the free passage of the blood through the openings of the heart, thereby inducing secondary changes, which take place slowly at first, but ultimately seriously impair the animal's usefulness. What was but a slight obstruction to the circulation during the first few weeks after the subsidence of the cardiac inflammatory attack becomes in process of time so much increased as to induce increased growth in the muscular structure of the heart, constituting hypertrophy of the walls of the ventricles, particularly of the left, with corresponding fullness of the left auricle and pulmonary veins, thereby producing fullness of the capillaries in the lungs, pressure on the air cells, difficult or asthmatic breathing—greatly increased in attempts to work—until in a few months many of the affected animals become entirely disabled for work. Sometimes, too, dropsical effusions in the legs or into the cavities of the body result from the irregular and deficient circulation. Derangement of the urinary secretion, with passive congestion of the kidneys, may also appear.

Endocardial inflammation is seldom fatal in its early stages, but in many cases the recovery is incomplete, for a large proportion is left with some permanent thickening of the valves, which constitutes the beginning of valvular disease.

Symptoms.—The first symptom of endocarditis may be a chill, with sudden and marked rise in temperature. The pulse rapidly decreases in strength or may become irregular, and the heart beats more or less tumultuously. In the early stages soft-blowing sounds may be heard by placing the ear over the heart on the left side, which correspond in number and rhythm to the heart's action. Excessive pain, though not so great as in acute pleuritis, is manifested when the animal is compelled to trot; often difficulty in breathing or shortness of breath on the slightest exertion develops early in the attack. When the valves are involved in the inflammatory process the visible mucous membranes become either very pale or very dark colored, and fainting may occur when the head is suddenly elevated. When the valves of the right side are affected there may be a regurgitant pulsation in the jugular vein. Occasionally the heart contracts more frequently than the pulse beats—that is, there may be twice as many contractions of the heart in a minute as there are pulse waves in the arteries. The pulse is always very fast. In some cases there is marked lameness of the left shoulder, and when the animal is turned short to the left side it may groan with pain and the heart's action become violently excited, although pressure against the chest wall will not produce pain unless roughly applied. The animal is not disposed to eat or drink much; the surfaces of the body and legs are cold—rarely excessively hot—and frequently the body of the animal is in a subdued tremor. In nearly all cases there is partial suppression of the urinary secretion.

The symptoms may continue with little modification for 3 or 4 days, sometimes 7 days, without any marked changes. If large fibrinous clots form in the heart the change will be sudden and quickly prove fatal unless they become loosened and are carried away in the circulation; then apoplexy may result from the plugging of arteries too small to give further transmission. If there are symptoms of improvement, the changes usually are slow and steady until the animal feels apparently as well as ever, eats well, and moves freely in the stall or yard. When the horse is taken out, however, the seeming strength often proves deceptive, as the animal may quickly weaken if urged into a fast gait, the breathing becomes quickened with a double flank movement as in heaves, and all the former symptoms reappear in a modified degree. An examination at this stage may reveal valvular insufficiency, cardiac hypertrophy, or pulmonary engorgement.

In fatal cases of endocarditis death often occurs about the fourth day from the formation of the heart clot or too great impediment of the circulation. Endocarditis may be suspected in all cases in which plain symptoms of cardiac affection are manifested in animals affected with influenza, rheumatism, or any disease in which the blood may convey septic matter.

Acute endocardial inflammation may be distinguished from pleuritis by the absence of any friction murmur, absence of pain when the chest wall is percussed, and the absence of effusion in the cavity of the chest. It may be distinguished from pericarditis by the absence of the friction sounds and of an enlarged area of dullness on percussion.

Treatment.—The objects to be attained by treatment are to remove or mitigate as much as possible the cause inducing the disease; to find a medicine that will lessen the irritability of the heart without weakening it; and, last, to maintain a free urinary secretion and prevent exudation and hypertrophy. As long as there is an increase of temperature, with some degree of scantiness of the urine, there is some inflammatory action in the cardiac structures, and as long as any evidence of inflammatory action remains, however moderate in degree, there is a tendency to increase or hypertrophy of the connective tissue of the heart or valves, thereby making it almost certain that the structural changes will become permanent unless counteracted by persistent treatment and complete rest.

Even in those animals in which the disease can be definitely diagnosed, no drug or combination of drugs is suitable for every use. Since the choice of medicine depends on technical consideration, this should be left to the veterinarian. Blistering and stimulating applications to the chest should be avoided. They serve to irritate the animal and can do no possible good. In all cases absolute rest, warm stabling, and blanketing are necessary, and freedom from work should be allowed for a long time after all symptoms have disappeared.

PERICARDITIS (INFLAMMATION OF THE SAC ENCLOSING THE HEART)

Causes.—Pericarditis may be induced by cold and damp stabling, exposure and fatigue, wounds caused by broken ribs, etc. Generally, however, it is associated with an attack of influenza, rheumatism, pleuritis, etc.

Symptoms.—Usually the disease manifests itself abruptly by a brief stage of chills coincident with pain in moving, a short painful cough, rapid and short breathing, and high temperature, with a rapid and hard pulse. In the early stages of the disease the pulse is regular in beat; later, when there is much exudation present in the pericardial sac, the heartbeat becomes muffled and may be of a double or rebounding character. By placing the ear against the left side of the chest behind the elbow a rasping sound may be heard, corresponding to the frequency of the heartbeat. This is known as a friction sound. Between the second and fourth days this sound may disappear, owing to a distension of the pericardium by an exudate or serous effusion. As soon as this effusion partly fills the pericardium, percussion will reveal an abnormally increased area of dullness over the region of the heart, the heartbeats become less perceptible than in health, and in some cases a splashing or flapping sound may become audible.

If the effusion becomes absorbed, the friction sound usually recurs for a short time; this friction may often be felt by applying the hand to the side of the chest. In a few cases clonic spasms of the muscles of the neck may be present. In acute pericarditis, when the effusion is rapid and excessive, the animal may die in a few days or recovery may begin equally as early. In subacute or in chronic cases the effusion may slowly become augmented until the pressure on the lungs and interference with the circulation become so great that death will result. Whether the attack is acute, subacute, or chronic, the characteristic symptoms that will guide to a correct diagnosis are the friction sound, which is always synchronous with the heart's action, the high temperature with hard, irritable pulse, and, in cases of pericardial effusion, the increased area of dullness over the cardiac region. When the disease is associated with influenza or rheumatism, some of the symptoms may be obscure, but a careful examination will reveal sufficient evidence on which to base a diagnosis. When pericarditis develops as a result of or in connection with pleuritis, the distinction may not be clearly definable, neither will many recover. When it results from a wound or broken rib, it almost invariably proves fatal.

Pathology.—Pericarditis should at all times be regarded as a serious affection. At first there is an intense injection or accumulation of blood in the vessel of the pericardium, giving it a red and swollen

appearance, during which the friction sound occurs. In 24 to 48 hours this engorgement is followed by an exudation of serofibrinous fluid, the fibrinous portion of which may soon form a coating over the internal surface of the pericardial sac and may ultimately form a union of the opposing surfaces. Generally this adhesion will occupy only a portion of the surfaces. As the serous or watery portion of this effusion is absorbed, the distinctness of the friction sound recurs and may remain perceptible in a varied degree for a long time. When the serous effusion is great, the pressure exerted on the heart weakens its action and may soon produce death; when it is not so great, it may cause dropsies of other portions of the body. When the adhesions of the pericardial sac to the body of the heart are extensive, they generally lead to increased growth, or hypertrophy, of the heart, with or without dilatation of its cavities; when they are slight, they may not cause any inconvenience.

Treatment.—Bandages may be applied to the legs, but if the legs are very cold, tincture of capsicum might first be applied. The body should be warmly clothed in blankets to promote perspiration. Cold packs to the chest in the early stages of the disease may give marked relief or, late in the disease, blistering agents may be applied to the sides of the chest with benefit. Since pericarditis is usually a complication of some general disease, conditions other than the inflammation of the heart sac must be taken into consideration when medicating affected animals. Various stimulants are often used in the acute stages. Later, general tonics and various strengthening medicines are sometimes of benefit. When the effusion is great and threatens the life of the patient, tapping by a competent veterinarian may save the animal.

VALVULAR DISEASE OF THE HEART

Acute valvular disease cannot be distinguished from endocarditis, and chronic valvular affections are generally the result of endocardial inflammation. The valves of the left side are the most subject—the bicuspid or mitral and the aortic or semilunar. The derangement may consist of mere inflammation and swelling, or the edges of the valves may become covered by the organization of the exudation, thus narrowing the passage. Valvular obstruction and adhesions may occur or the tendinous cords may be lengthened or shortened, thus obstructing the orifices and permitting the regurgitation of blood. In projected cases the fibrous tissue of the valves may be transformed into fibro-cartilage or bone, or there may be deposits of salts of lime beneath the serous membrane, which may terminate in ulceration, rupture, or fissures. Sometimes the valves become covered by fibrinous, fleshy, or hard vegetations, or excrescences. In cases of considerable dilatation of the heart there may be atrophy and shrinking of the valves.

Symptoms.—Valvular disease may be indicated by a venous, jerking,

intermittent, or irregular pulse; palpitation; constant abnormal fullness of the jugular veins; difficulty of breathing when the animal becomes excited or is urged out of a walk or into a fast trot; attacks of vertigo; congestion of the brain; dropsical swelling of the legs. A blowing, cooing, or bubbling murmur may sometimes be heard by placing the ear over the heart on the left side of the chest.

Hypertrophy, or dilatation, or both, usually follow valvular disease.

Treatment.—Few animals recover or remain useful for any length of time after marked organic changes have taken place in the valvular structure of the heart. General good care and the appropriate use of various tonics or stimulants may be helpful in prolonging the usefulness of the animal.

ADVENTITIOUS GROWTHS IN THE HEART

Fibrous, cartilaginous, and bony formations have been observed in rare instances in the muscular tissue. Isolated calcareous masses have sometimes been embedded in the cardiac walls. Fibrinous coagula and polypous concretions may be found in the cavities of the heart. The former consist of coagulated fibrin, separated from the mass of blood, of a whitish or yellowish-white color, translucent, of a jellylike consistence, and having a nucleus in the center. They may slightly adhere to the surface of the cavity, from which they can easily be separated without altering the structure of the endocardium. They probably result from an excess of coagulability of fibrin, which is produced by an organization of the lymph during exudation. They are usually found in the right auricle and ventricle.

Polypous concretions are firmer than in the fibrinous coagula, more opaque, of a fibrous texture, and may be composed of successive layers. In some instances they are exceedingly minute, whereas in others they almost fill one or more of the cavities. Their color is usually white but occasionally red from the presence of blood. They firmly adhere to the endocardium and when detached from it give it a torn appearance. Occasionally, a vascular communication seems to exist between them and the substance of the heart. They may be the result of fibrinous exudation from inflammation of the inner surface of the heart or the coagulation of a portion of the blood that afterwards contracts adhesion with the heart. These concretions are a source of great inconvenience and often danger, no matter how formed. They cause a diminution in the cavity in which they are found, thus narrowing the orifice through which the blood passes, or preventing a proper coaptation of the valves, which may produce serious valvular disease.

Symptoms.—These are frequently uncertain; they may, however, be suspected when the action of the heart suddenly becomes impeded with irregular and confused pulsations, great difficulty of breathing, and the usual signs denoting the imperfect arterialization of the blood.

Treatment.—Stimulants, such as whisky or ammonium carbonate, may be of temporary service, but there is no practical remedy for the removal of the growths themselves.

PALPITATION OF THE HEART

This is a tumultuous and usually irregular beating of the heart. It may be due to a variety of causes, both functional and organic. It may occur as a result of indigestion, fright, increased nervousness, sudden excitement, excessive speeding, etc. (See Thumps, p. 113.)

Symptoms.—The heart may act with such violence that each beat may jar the whole body of the animal; commonly it may be heard at a short distance away from the animal. It can usually be traced readily to the exciting cause, which may be avoided or overcome in the future, thereby obviating subsequent attacks. Rest is essential and will generally give some relief. When it is due to organic impairment of the heart it must be regarded as a symptom, not as a matter of primary specific treatment.

FAINTING (SYNCOPE)

Actual fainting rarely occurs among horses. It may, however, be induced by such causes as a rapid and great loss of blood, pain of great intensity, and a mechanical interference with the circulation of the brain.

Symptoms.—Fainting is characterized by a decrease or temporary suspension of the action of the heart and respiration, with partial or total loss of consciousness. It generally occurs suddenly, though there may be premonitory symptoms, as giddiness, or vertigo, dilated pupil, staggering, blanching of the visible mucous membranes, a rapidly sinking pulse, and dropping to the ground. The pulse is feeble or ceases to beat; the surface of the body turns cold; breathing is scarcely to be perceived, and the animal may be entirely unconscious. This state is uncertain in duration—generally it lasts only a few minutes; the circulation becomes restored, breathing becomes more distinct, and consciousness and muscular strength return. In cases attended with much hemorrhage or organic disease of the heart, the fainting fit may be fatal; otherwise it will be only transient. In paralysis of the heart the symptoms may be exactly like those of fainting. This condition may be distinguished from apoplexy by the absence of stertorous breathing and lividity of the visible mucous membranes.

Treatment.—Dash cold water on the head; administer a stimulant. Prevent the animal from getting up too soon, or the attack may recur immediately. Afterwards, if the attack was due to weakness from loss of blood, impoverished blood, or associated with debility, general tonics, rest, and nourishing feeds are beneficial.

HYPERTROPHY OF THE HEART (CARDIAC ENLARGEMENT)

Hypertrophy of the heart implies augmentation of bulk in its muscular substance, with or without dilatation or contraction of its cavities. It may exist with or without other cardiac affections. In valvular disease or valvular insufficiency, hypertrophy frequently results as a consequence of increased demand for propelling power. The difficulties with which it is most frequently connected are dilatation and ossification of the valves. It may also occur in connection with atrophied kidneys, weak heart, and similar affections. It may be caused by an increased flow of blood to the organ or from a latent form of myocarditis, and it may arise from a long-continued increase of action dependent on nervous disease. All the cavities of the heart may have their walls hypertrophied or the thickening may involve one or more. While the wall of a ventricle is thickened, its cavity may retain its normal size (simple hypertrophy) or be dilated (eccentric hypertrophy), or it may be contracted (concentric hypertrophy). Hypertrophy of both ventricles increases the length and breadth of the heart. Hypertrophy of the left ventricle alone increases its length; of the right ventricle alone increases its breadth toward the right side. Hypertrophy with dilatation may affect the chambers of the heart conjointly or separately. This is by far the most frequent form of cardiac enlargement. When the entire heart is affected, it assumes a globular appearance, the apex being almost obliterated and situated transversely in the chest. The bulk may become three or four times greater than the average heart.

Symptoms.—In hypertrophy of the heart, in addition to the usual symptoms manifested in organic diseases of the heart, there is a powerful and heaving impulse at each beat, which may be felt on the left side, often also on the right. These pulsations are regular, and when full and strong at the jaw there is a tendency to active congestion of the capillary vessels, which frequently give rise to local inflammation, active hemorrhage, and similar conditions. If the pulse is feeble at the jaw, there is some obstacle to the escape of the blood from the left ventricle into the aorta, that has given rise to the hypertrophy. In case of hypertrophy with dilatation, the impulse is not only powerful and heaving, but it is diffused over the whole region of the heart, and the normal sounds of the heart are greatly increased in intensity. Percussion reveals an enlarged area of dullness, whereas the impulse is usually much stronger than normal.

Dropsy of the pericardium will give the same wide space of dullness, but the impulse and sound are lessened. An animal with a moderate degree of enlargement may live a number of years and be capable of ordinary work; it depends largely on concomitant disease. As a rule, an animal affected with hypertrophy of the heart will soon be incapacitated for work and become useless and incurable.

Treatment.—If possible, the cause should be discovered and removed. Freedom from excitement or fatigue, avoidance of bulky feeds, and good ventilation are likely to be beneficial.

DILATATION OF THE HEART

This is an enlargement, or stretching, of the cavities of the heart and may be confined to one or extend to all. Two forms of dilatation are simple dilatation, in which there is normal thickness of the walls, and passive, or attenuated, dilatation, in which the walls are simply distended or stretched without any addition of substance.

Causes.—Any cause producing constant and excessive exertion of the heart may lead to dilatation. Valvular disease is the most frequent cause. General anemia predisposes to it by producing relaxation of muscular fiber. Changes in the muscular tissue of the heart walls, serous infiltration from pericarditis, myocarditis, fatty degeneration and infiltration, and atrophy of the muscular fibers may all lead to dilatation.

Symptoms.—The movements of the heart are feeble and prolonged, there are a disposition to staggering or vertigo, dropsy of the legs, very pale or very dark-colored membranes, and difficult breathing on the slightest excitement.

Treatment.—This consists of tonics, rich feed, and rest.

FATTY DEGENERATION OF THE HEART

Fatty degeneration may involve the whole organ or be limited to its walls or even to circumscribed patches. The patches are situated at the exterior and give it a mottled appearance. When generally involved, the heart is flabby or flaccid and in extreme cases collapses when emptied or cut. On dissection the interior of the ventricles is observed to be covered with buff-colored spots of a singularly zigzag form. This appearance may be noticed beneath the pericardium and pervading the whole thickness of the ventricular walls, and in extreme cases those of the fleshy columns in the interior of the heart. These spots are found to be degenerated muscular fibers and colonies of oil globules. Fatty degeneration is often associated with other morbid conditions of the heart, such as obesity, dilatation, rupture, or aneurysm. It may be connected with fatty diseases of other organs, such as the liver or kidneys. When it exists alone its presence is seldom suspected previous to death. It may be secondary to hypertrophy of the heart, to myocarditis, or to pericarditis. It may be due to deteriorated conditions of the blood in wasting diseases or excessive hemorrhages, or to poisoning with arsenic and phosphorus.

Symptoms.—The most prominent symptoms of fatty degeneration are a feeble action of the heart, a remarkably slow pulse, general debility, and attacks of vertigo. It may exist for a long time but is

likely to terminate suddenly in death on the occurrence of other diseases, or surgical operations. It may involve a liability to sudden death from rupture of the ventricular walls.

Treatment.—The feed should be limited to oats, wheat or rye bran, and timothy hay. Tonics and stimulants may be administered.

RUPTURE OF THE HEART

This may occur as the result of some previous disease, such as fatty degeneration or dilatation with weakness of the muscular walls. It may be caused by external violence, a crushing fall, pressure of some great weight, and similar circumstances. Usually death follows a rupture very quickly, though an animal may live for some time when the rent is not large.

WEAKNESS OF THE HEART

This may arise from general debility, the result of exhausting disease, overwork heart strain, or loss of blood. It is indicated by a feeble, but generally regular pulse, and coldness of the body.

Treatment should be directed to support and increase the strength of the animal by tonics, rest, and nutritious feed. Ammonium carbonate may be given to stimulate the heart's action and to prevent the formation of heart clot.

CONGESTION OF THE HEART

Congestion, or an accumulation of the blood in the cavities of the heart, may occur in consequence of fibrinous deposits interfering with the free movements of the valves, usually the product of endocarditis or of excessive muscular exertion.

Symptoms are great difficulty of breathing, paleness of the visible mucous membranes, great anxiety, frequently accompanied by a general tremor and cold perspiration, followed by death. It usually results in death very quickly.

CYANOSIS OF NEWBORN FOALS

This is a condition sometimes found in foals immediately after birth and is due to nonclosure of the foramen ovale, which allows a mixture of the venous with the arterial blood in the left cavities of the heart. It is characterized by a dark purple or bluish color of the visible mucous membranes, shortness of breath, and a general feebleness. Foals thus affected generally live only a few hours after birth.

DISEASES OF ARTERIES (ARTERITIS AND ENDARTERITIS)

Inflammation of arteries is rarely observed in the horse as a primary affection. Direct injuries, such as blows, may produce a contusion and subsequent inflammation of the wall of an artery; severe muscular strain may involve an arterial trunk; hypertrophy of the

heart, by increasing arterial tension, may result in the production of a general endarteritis. Septic infection may affect the inner coat and ultimately involve all three, or it may be the result of an inflammation in the vicinity of the vessels, or other causes. Inflammation of arteries, whatever the cause may be, often leads to serious results in the development of secondary changes in their walls. Arteritis may be acute, subacute, or chronic; when the inner coat alone is affected it is known as endarteritis.

Symptoms.—Arteritis is characterized by a painful swelling along the inflamed vessel, throbbing pulse, coldness of the parts supplied by the inflamed vessel, sometimes the formation of gangrenous sloughs, suppuration, or abscess. In an inflammation of the iliac arteries there are coldness and excessive lameness or paralysis of one or both hind legs.

Pathology.—Acute arteritis is indicated by swelling along the vessel, loss of elasticity, friability, and thickening of the walls; a roughness and loss of gloss of the inner coat, with the formation of coagula or pus in the vessel. Subacute or chronic arteritis may affect only the outer coat (periarteritis), both the outer and middle coat, or the inner coat alone (endarteritis); and by weakening the respective coats leads to rupture, aneurism, or to degenerations, such as bony, calcareous, fatty, and atheromatous. It may lead also to sclerosis or increased fibrous tissue, especially in the kidneys, when it may result in the condition known as arterio-capillary fibrosis. Chronic endarteritis is fruitful in the production of thrombus and atheroma. Arteritis may be limited to single trunks or it may affect, more or less, all the arteries of the body. Arteries that are at the seat of chronic endarteritis are likely to suffer degenerative changes, consisting chiefly of fatty degeneration, calcification, or the breaking down of the degenerated tissue, and the formation of erosions or ulcerlike openings in the inner coat. These erosions are frequently called atheromatous ulcers, and fragments of tissue from these ulcers may be carried into the circulation, forming emboli. Fibrinous thrombi are apt to form on the roughened surface of the inner coat or on the surface of the erosions.

Fatty degeneration and calcification of the middle and outer coats may occur, and large, hard, calcareous plates project inward, on which thrombi may form or may exist in connection with atheroma of the inner coat. When there are much thickening and increase of new tissue in the wall of the affected artery it may encroach on the capacity of the vessel and even lead to obliteration. This is often associated with interstitial inflammation of glandular organs.

Treatment.—Although heart stimulants and tonics may be used, medicinal treatment is of little avail. Careful dieting to maintain the strength of the animal, including the use of scalded bran sufficient to produce loosening of the bowels, and complete rest, are advised.

ATHEROMA

Atheroma is a direct result of an existing chronic endarteritis, the lining membrane of the vessels being invariably involved to a greater or less degree. It is most frequently found in the arteries, although the veins may develop an atheromatous condition when exposed to any source of prolonged irritation. Atheroma may affect arteries in any part of the body; in some instances almost every vessel is diseased, in others only a few, or even parts of one vessel. It is a common result of endocarditis extending into the aorta, which is perhaps the most frequent seat of atheroma. As a result of this condition the affected vessel becomes impaired in its contractile power, loses its natural strength, and, in consequence of its inability to sustain its accustomed internal pressure, undergoes in many cases dilatation at the seat of disease, constituting aneurism. In an atheromatous vessel, calcareous deposits soon occur, which render it rigid, brittle, and subject to ulceration or rupture. In such vessels the contractility is destroyed, the middle coat atrophied and beyond repair. Atheroma in the vessels of the brain is a frequent cause of cerebral apoplexy. No symptoms are manifested by which this condition can be recognized during life.

CONSTRICTION OF AN ARTERY

This is usually the result of arteritis. The affected artery may be partly or wholly impervious to the flow of blood. When this occurs in a large vessel it may be followed by gangrene of the parts; usually, however, collateral circulation will be established to nourish the parts previously supplied by the obliterated vessel. In a few instances constriction of the aorta has produced death.

ANEURISM

Aneurism is usually described as true or false. True aneurism is a dilatation of the coats of an artery over a larger or smaller part of its course. Such dilatations are usually due to chronic endarteritis and atheroma. False aneurism is formed after a puncture of an artery by a dilatation of the adhesive lymph by which the puncture was united.

Symptoms.—If the aneurism is situated along the neck or a leg it appears as a tumor in the course of an artery and pulsates with it. The tumor is round, soft, and compressible and yields a peculiar fluctuation on pressure. By applying the ear over it a peculiar purring or hissing sound may sometimes be heard. Pulsation, synchronous with the action of the heart, is the diagnostic symptom. It is of a slow, expansive, and heavy character, as if the whole tumor were enlarging under the hand. Aneurisms situated internally may occupy the cavity of the cranium, chest, or abdomen. As regards the first, little is known during life, for all the symptoms that they pro-

duce may arise from other causes. Aneurism of the anterior aorta may be situated very close to the heart or in the arch, and it can seldom be distinguished from disease of the heart. The tumor may encroach on the windpipe and produce difficulty in breathing, or it may produce pressure on the vena cava or the thoracic duct, obstructing the flow of blood and lymph. In fact, whatever parts the aneurism may reach or subject to its pressure may have their functions suspended or disturbed. When the tumor in the chest is large, much irregularity is generally found in the action of the heart; the superficial veins of the neck are distended, and there is usually dropsical swelling under the breast and of the legs. There may be a troublesome cough without any evidence of lung affection. Sometimes pulsation of the tumor may be felt at the lower part of the neck where it joins the chest. When the aneurism occurs in the posterior aorta no diagnostic symptoms are appreciable. When it occurs in the internal iliac arteries an examination per rectum will reveal it.

There is one form of aneurism that is frequently overlooked, affecting the anterior mesenteric artery, primarily induced by a worm, *Strongylus vulgaris*. This worm produces an arteritis, with atheroma, degeneration, and dilatation of the mesenteric arteries, associated with thrombus and aneurism. The aneurism gives rise to colic, which appears periodically in a violent and often persistent type. Ordinary colic remedies have no effect, and after a time the animal succumbs to the disease. In animals that are habitually subject to colicky attacks, parasitic aneurism of the anterior mesenteric artery may be suspected. (See p. 285.)

Pathology.—Aneurisms may be diffuse or sacculated. The diffuse form consists in a uniform dilatation of all the coats of an artery, so that it assumes the shape of a cylindrical swelling. The wall of the aneurism is atheromatous, or calcified; the middle coat may be atrophied. The sacculated, or circumscribed, aneurism consists either in a dilatation of the entire circumference of an artery over a short portion of its length, or in a dilatation of only a small portion of one side of the wall. Aneurism may become very large; as it increases in size it presses upon and causes the destruction of neighboring tissues. The cavity of the aneurismal sac is filled with fluid or clotted blood or with layers of fibrin that adhere closely to its wall. Death is produced usually by the pressure and interference of the aneurism with adjoining organs or by rupture. In aneurism caused by worms, large thrombi usually are found within the aneurismal dilatation of the artery, which sometimes plug the whole vessel or extend into the aorta. Portions of this thrombus, or clot, may be washed away and produce embolism of a smaller artery. The effect in either case is to produce anemia of the intestinal canal, serous or bloody exudation in

its walls, which leads to paralysis of the intestine and resultant colicky symptoms.

Treatment.—There is no successful treatment for aneurism caused by *Strongylus vulgaris*.

RUPTURE OF AN ARTERY

Endarteritis, with its subsequent changes in the walls of arteries, is the primary cause of rupture in most instances. The rupture may be partial, involving only one or two coats, and will then form an aneurism. If complete, it may produce death when it involves a large vessel, especially if it is situated in one of the large cavities, permitting an excessive escape of blood. Rupture may be produced by mechanical violence or accident.

Symptoms.—In fatal rupture, associated with profuse bleeding, the animal becomes weak, the visible mucous membranes blanched, the breathing hurried or gasping, pupils dilated, gait staggering; fainting, and then death occurs. When hemorrhage is limited the symptoms may not become noticeable; if it is near the surface of the body a round or diffuse swelling or tumor may form, constituting a blood clot. If the rupture is associated with an external wound, the bleeding artery should be ligated, or if a bandage is applicable, pressure may be applied by tight bandaging. As a secondary result of rupture of an artery there may be formation of abscess or gangrene of a part.

Treatment.—When rupture of a deep-seated artery is suspected, certain agents that tend to aid in coagulating the blood may be used. The animal should be allowed to have as much water as it desires. Afterwards stimulants and nourishing feed are beneficial.

THROMBUS AND EMBOLISM

By thrombosis is generally understood the partial or complete closure of a vessel by a morbid product developed at the site of the obstruction. The coagulum, which is usually fibrinous, is known as a thrombus. The term "embolism" designates an obstruction caused by any body detached and transported from the interior of the heart or of some vessel. Thrombi occur as the result of an injury to the wall of the vessel or may follow its compression or dilatation; they may result from some alteration of the wall of the vessel by disease or by the retardation of the circulation. These formations may occur, during life, in the heart, arteries, veins, or in the portal system. When a portion of fibrin coagulates in one of the arteries and is carried along by the circulation, it will be arrested in the capillaries, if not before; when in the veins, it may not be stopped until it reaches the lungs; and when in the portal system, the capillaries of the liver

will prevent its further progress. The formation of thrombi may act primarily by causing partial or complete obstruction, and, secondarily, either by larger or smaller fragments becoming detached and by being carried along by the circulation of the blood to remote vessels, causing embolism; or by the coagulum's becoming infected and converted into pus, constituting suppurative phlebitis. These substances occur most frequently in those affections characterized by great exhaustion or debility, such as pneumonia, purpura hemorrhagica, endocarditis, phlebitis, puerperal fever, and hemorrhages. These concretions may form suddenly and produce instantaneous death by retarding the blood current, or they may arise gradually, in which case the thrombi may be organized and attached to the walls of the heart, or they may soften, and fragments of them (emboli) may be carried away. The small, wartlike excrescences occurring sometimes in endocarditis may occasionally form a foundation on which a thrombus may develop.

Symptoms.—When heart clot, or thrombus, exists in the right side, the return of blood from the body and the aëration in the lungs is impeded, and if death occurs, it is due to fainting rather than to strangulation in pulmonary respiration. There will be hurried and gasping breathing, paleness and coldness of the surface of the body, a feeble and intermittent or fluttering pulse, and fainting. When a fibrinous coagulum is carried into the pulmonary artery from the right side of the heart, the indications are a swelling and infiltration of the lungs and pulmonary apoplexy. When the clot is situated in the left cavities of the heart or in the aorta, death, if it occurs, takes place either suddenly or at the end of a few hours.

Pathology.—When a coagulum is observed in the heart it may be a question whether it was formed during life or after death. The loose, dark coagula often found after death are polypi. If the deposition has taken place during the last moments of life, the fibrin will be isolated and soft but not adherent to the walls; if it is isolated, dense, and adherent or closely intertwined with the muscles of the papillae and tendinous cords, the deposition has occurred a considerable time before death. Occasionally the fibrin may be seen lining one of the cavities of the heart, like a false endocardium, or forming an additional coat to the aorta or other large vessels without producing much obstruction. Thrombi, in some instances, soften in their centers, and are then observed to contain a puslike substance. If this softening has extended considerably, an outer shell, or cyst, only may remain. The sources of danger exist not only in the interruption of the circulation of the blood, but also in a morbid state of the system, produced by the disturbed nutrition of a leg or organ, as well as the mingling of purulent and gangrenous elements with the blood.

Treatment.—The urgent symptoms should be relieved by rest. Stimulants and agents that will act as solvents to the fibrinous clots may be administered. In cases of great debility associated with a low grade of fever, stimulants and tonics may be beneficial.

DISEASES OF VEINS (PHLEBITIS)

Inflammation of veins may be simple or diffuse. In simple phlebitis the disease of the vein is confined to a circumscribed or limited portion of a vein; in diffuse phlebitis it involves the vein for a long distance; it may even extend from a foot to the heart.

Causes.—Phlebitis may be induced by contusions or direct injuries, an extension of inflammation from surrounding tissue, such as in abscess, formation of tumor, or malignant growth. It is often due to embolism of infective material, gangrenous matter, and similar causes. Blood-letting from the jugular vein is occasionally followed by dangerous phlebitis.

Symptoms.—The symptoms vary according to the extent and severity of the inflammation. In most cases the vein is swollen, thickened, and indurated to such a degree as to resemble an artery. A diffused swelling, with great tenderness, may extend along the affected vessel and the animal manifest all the symptoms connected with acute fever and general functional disturbance.

Pathology.—The disease is serious only when large veins are affected. The coats undergo the same changes as in arteritis; clots of blood and lymph plug the inflamed vessel, and, if the inflammatory process continues, these are converted into pus, which ruptures the vessel and produces deep abscesses; or it may be carried away in the circulation and produce metastatic abscesses in the lungs or other remote organs. In mild cases the clots may become absorbed and the vessel restored to health. Phlebitis in the course of the veins of the legs frequently leads to numerous abscesses, which may be mistaken for farcy ulcerations. A common result of phlebitis is an obliteration of the affected portion of the vein, but as collateral circulation is readily established this is seldom of any material inconvenience.

Treatment.—Phlebitis may be treated by hot fomentation or the application of a blistering agent along the course of the inflamed vessel and early opening of any abscesses which may form. The animal should have complete rest and the bowels be kept loose with bran mash. The surgical removal of the affected vessels is sometimes necessary. The operation should be undertaken only by a competent veterinarian.

VARICOSE VEINS (VARIX OR DILATATION OF VEINS)

This condition may be a result of weakening of the coats of veins by inflammatory disease and degeneration. It may also be due to mechanical obstruction from internal or external sources. It is

sometimes found in the vein that lies just beneath the skin over the inside of the hock joint and may be due to the pressure of a spavin. Occasionally it may be observed in stallions, which are more or less subject to varicocele, or dilatation of the veins of the testicular cord. Hemorrhoidal veins, or piles, occasionally occur, generally in horses that are on pasture. Varicose veins may ulcerate and form an abscess in the surrounding tissues, or they may rupture from internal blood pressure and the blood form large tumors where the tissues are soft.

Treatment.—Stallions that manifest a tendency to varicocele should wear suspensory bags when they are exercised. Piles may often be reduced by astringent washes—tea made from white-oak bark or a saturated solution of alum. The bowels should be kept loose with bran mash and the animal kept quiet in the stable. When varicose veins exist superficially and threaten to produce inconvenience, they may be ligated above and below and thus obliterated. Sometimes absorption may be induced by constant bandages.

AIR IN VEINS (AIR EMBOLISM)

It was formerly supposed that the entrance of air into a vein at the time of the infliction of a wound or in bleeding was extremely dangerous and often produced sudden death by interfering with the circulation of the blood through the heart and lungs. Danger from air embolism is exceedingly doubtful, unless great quantities are forced into a large vein by artificial means.

PURPURA HEMORRHAGICA

Purpura hemorrhagica usually occurs as a sequel to debilitating diseases, such as strangles or influenza. It may arise, however, in the absence of any previous disease in badly ventilated stables, among poorly fed horses, and in animals subject to exhausting work and extreme temperatures. Its gravity does not depend so much on the quantity of blood extravasated as on the disturbance or diminished action of the vasomotor centers.

Symptoms.—This disease is manifested by the occurrence of sudden swellings on various parts of the body—the head or lips, legs or abdomen, for instance. These swellings may be diffused or very markedly circumscribed, though in the advanced stages they cover large areas. They pit on pressure and are slightly painful to the touch. The legs may swell to a large size, the nostrils may become almost closed, and the head and throat may swell to the point of suffocation. The swellings frequently disappear from one portion of the body and develop on another, or they may recede from the surface and invade the intestinal mucous membrane. The mucous lining of the nostrils and mouth have more or less dark-red or purple spots. There may

be a discharge of blood-colored serum from the nostrils; the tongue may be swollen so as to prevent eating or closing of the jaws. In the most intense cases, within 24 to 48 hours bloody serum may exude through the skin over the swollen parts, and finally large gangrenous sloughs may form. The temperature is never very high, the pulse is frequent and compressible and becomes feebler as the animal loses strength. A cough is usually present. The urine is scanty and highly colored, and when the intestines are much affected a bloody diarrhea may set in, with colicky pains. Some of the internal organs become implicated in the disease, the lungs may become edematous, extravasation may occur in the intestinal canal, or in the cavity of the chest or abdomen. In some instances the brain may become affected. A few cases run a mild course, and recovery may commence in 3 or 4 days; generally, however, the outlook is unfavorable. In severe cases septic poisoning is likely to occur, which soon causes death.

Pathology.—On section, capillaries are found to be dilated, the connective tissue filled with a coagulable or coagulated lymph, and frequently gangrenous spots beneath the skin or involving the skin. The lymphatic glands are swollen and inflamed. Extensive extravasations of blood may be found embedded between the coats of the intestines, or excessive effusion into the substance of the lungs.

Treatment.—The animal should be made comfortable in a well-bedded box stall and provided with soft mashes or green feed. Diffusible stimulants and tonics may be given, but other symptomatic treatment is usually not advisable. Drenching or giving boluses should be avoided because of the difficulty in swallowing. Medicaments should be given in small quantities or by the use of an electuary. Such procedures as blood transfusions and intravenous injections of certain agents should be undertaken only by a competent veterinarian.

DISEASES OF THE LYMPHATIC SYSTEM

The lymphatic, or absorbent, system is connected with the blood-vascular system and consists of a series of tubes that absorb and convey to the blood certain fluids. These tubes lead to lymphatic glands, through which the fluids pass to reach the right lymphatic vein and thoracic duct, both of which enter the venous system near the heart. Through the excessively thin walls of the capillaries the fluid part of the blood transudes to nourish the tissues outside the capillaries; at the same time fluid passes from the tissues into the blood. The fluid, after it passes into the tissues, constitutes the lymph and acts like a stream irrigating the tissue elements. Much of the surplus of this lymph passes into the lymph vessels, which in their commencement can hardly be treated as independent structures, since their walls are so closely joined with the tissues through which they

pass, being nothing more than spaces in the connective tissue until they reach the larger lymph vessels, which finally empty into lymph glands. These lymph glands are structures so placed that the lymph flowing toward the larger trunks passes through them, undergoing a sort of filtration. Because of this arrangement lymph glands are subject to inflammatory diseases in the vicinity of diseased structures, as infective material being conveyed in the lymph stream lodges in the glands and produces irritation.

LOCAL INFLAMMATION AND ABSCESS OF LYMPHATIC GLANDS

Acute inflammation of the lymph glands usually occurs in connection with some inflammatory process in the region from which its lymph is gathered. Several or all of the glands in a cluster may become affected, as in strangles, nasal catarrh, nasal gleet, or diseased or ulcerated teeth. The lymph glands between the branches of the lower jaw almost invariably become affected, which may lead to suppuration or induration. Similar results are obtained in other portions of the body. In pneumonia, for instance, the bronchial glands become affected; in pharyngitis the postpharyngeal glands lying above the trachea become affected.

Symptoms.—The glands swell and become painful to the touch, the connective tissue surrounding them becomes involved, suppuration usually takes place, and one or more abscesses form. If the inflammation is of a milder type, resolution may take place and the swelling recede, the exudative material being absorbed and the gland restored without the occurrence of suppuration. In the legs a whole chain of the glands along the lymphatic vessels may become affected, as in farcy, phlebitis, or septic poisoning.

Treatment.—Fomentation with hot water and the application of camphorated soap liniment or camphorated oil may produce a revulsive action and prevent suppuration. If there is any indication of abscess forming, poultices of linseed meal and bran made into a paste with hot water may be applied, or a mild blistering ointment rubbed in over the swollen gland. As soon as fluctuation can be felt a free opening must be made for the escape of the pus. The wound may subsequently be treated with an antiseptic solution several times a day.

LYMPHANGITIS

Specific inflammation of the lymphatic structures usually affects the hind legs, but seldom a foreleg. This disease is sudden in its attack, exceedingly painful, and accompanied with a high temperature and great general disturbance.

Causes.—Horses of lymphatic or sluggish temperament are predisposed to this affection. It usually attacks well-fed animals and in

such cases may be due to an excess of nutritive elements in the blood. Sudden changes in work or in the habits of the animal may induce an attack.

Symptoms.—The first symptoms usually are a chill, rise in temperature, and some uneasiness; in a very short time these are followed by lameness in one leg and swelling on the inside of the thigh. The swelling gradually surrounds the whole leg and continues on downward until it reaches the foot. The leg is excessively tender to the touch, the animal perspires, the breathing is accelerated, pulse hard and quick, and the temperature may reach 106° F. Early in the disease the bowels become very constipated and urine scanty. The symptoms usually are on the increase for about 2 days and then remain stationary for the same length of time; the fever then abates; the swelling recedes and becomes less painful. However, all the swelling seldom leaves the leg; generally it leaves some permanent enlargement, and the animal becomes subject to recurrent attacks. Occasionally the inguinal lymphatic glands (in the groin) undergo suppuration, and pyemia may supervene and prove fatal. In severe cases the leg becomes denuded of hair in patches, and the skin remains indurated with a fibrous growth, which is known as elephantiasis.

Treatment.—The parts should be bathed freely and frequently with water as hot as the hand can bear and then with cold water or an astringent antiseptic solution. This alternate hot and cold bathing should be done frequently for the first day. Afterwards the leg may be dried with a woolen cloth and bathed with camphorated soap liniment. Internally, artificial Karlsbad salt in 2- to 4-ounce doses may be administered three times daily. Feed lightly and give complete rest. This treatment, if instituted early in the attack, may frequently bring about a remarkable change within 24 hours.

Diseases of the Eye

By JAMES LAW, F. R. C. V. S.

[Revised by WILLIAM S. GOCHENOUR, V. M. D.]

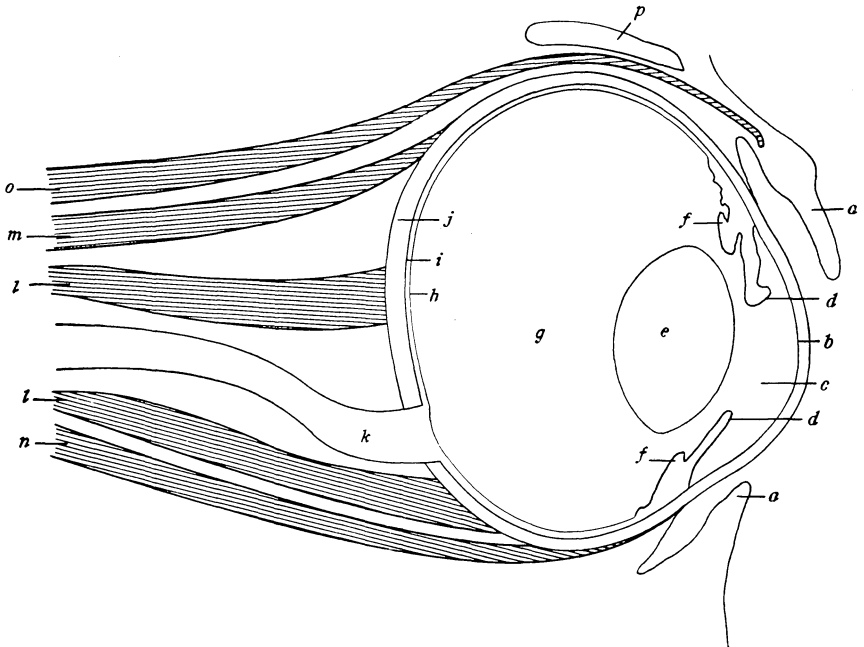
We can scarcely overestimate the value of sound eyes in the horse, and hence all diseases and injuries that seriously interfere with vision are matters of extreme gravity and apprehension, for should they prove permanent they invariably depreciate the usefulness of the animal and the selling price to a considerable extent. A blind horse is always dangerous in the saddle or in single harness, and he is scarcely less so when, with partially impaired vision, he sees things imperfectly, in a distorted form or in a wrong place, and when he shies or avoids objects that are commonplace or familiar.

STRUCTURE OF THE EYE

(Pl. XXII.)

THE EYEBALL

The horse's eye is a spheroidal body, flattened behind, and with its posterior four-fifths enclosed by an opaque, white, strong fibrous membrane (the sclera), on the inner side of which is laid a more delicate, friable membrane, consisting mainly of blood vessels and pigment cells (the choroid), which in its turn is lined by the extremely delicate and sensitive expansion of the nerve of sight (the retina). The anterior fifth of the globe of the eye bulges forward from what would have been the direct line of the sclera and thus forms a segment of a much smaller sphere than is enclosed by the sclera. Its walls, too, have in health a perfect translucency, from which it has derived the name "transparent cornea." This transparent coat is composed, in the main, of fibers with lymph interspaces, and it is to the condition of these and their condensation and compression that the translucency is largely due. This may be shown by compressing with the fingers the eye of an animal that has just been killed, when the clear transparent cornea will suddenly become clouded over with a whitish-blue opacity, and this will remain until the compression is interrupted. The interior of the eye contains three transparent media for the refraction of the rays of light on their way from the cornea to the visual nerve. Of these media the anterior one (aqueous humor) is liquid, the posterior (vitreous humor) is semisolid, and the intermediate one (crystalline lens) is solid.



a, Eyelid.
b, Cornea.
c, Aqueous humor.
d, Iris.
e, Lens.
f, Ciliary body.
g, Vitreous body.
h, Retina.

i, Choroid.
j, Sclera.
k, Optic nerve.
l, Retractor muscle.
m, Superior rectus (straight) muscle.
n, Inferior rectus (straight) muscle.
o, Elevator muscle of upper eyelid.
p, Lachrymal gland.

DIAGRAMMATIC VERTICAL SECTION THROUGH HORSE'S EYE.

The space occupied by the aqueous humor corresponds nearly to the portion of the eye covered by the transparent cornea. However, it is divided into two chambers, anterior and posterior, by the iris, a contractile curtain with a hole in the center (the pupil), and which may be looked on as in some sense a projection inward of the vascular and pigmentary coat from its anterior margin at the point where the sclera or opaque outer coat becomes continuous with the cornea or transparent one. This iris, or curtain, besides its abundance of blood vessels and pigment, possesses two sets of muscular fibers, one set radiating from the margin of the pupil to the outer border of the curtain at its attachment to the sclera and ciliary body, and the other encircling the pupil in the manner of a ring. The action of the two sets is necessarily antagonistic, the radiating fibers dilating the pupil and exposing the interior of the eye to view, whereas the circular fibers contract this opening and shut out the rays of light. The form of the pupil in the horse is ovoid, with its longest diameter from side to side, and its upper border is fringed by several minute, black bodies (*corpora nigra*) projecting forward and serving to some extent the purpose of eyebrows in arresting and absorbing the excess of rays of light that fall on the eye from above. These pigmentary projections in front of the upper border of the pupil are often mistaken for the products of disease or injury instead of normal and beneficent protectors of the nerve of sight. Like all other parts, they may become the seat of disease, but so long as they and the iris retain their clear, dark aspect, without any tints of brown or yellow, they may be considered healthy.

The vitreous or semisolid refracting medium occupies the posterior part of the eye—the part corresponding to the sclera, choroid, and retina—and has a consistence corresponding to that of the white of an egg, and a power of refraction of the light rays correspondingly greater than the aqueous humor.

Third or solid refracting medium is a biconvex lens, with its convexity greatest on its posterior surface, which is lodged in a depression in the vitreous humor. Its anterior surface corresponds to the opening of the pupil. It is enclosed in a membranous covering (capsule) and is maintained in position by the suspensory ligament, which extends from the margin of the lens outward to the ciliary body, which may be regarded as the thickened anterior continuation of the choroid. The ciliary body is, in its turn, furnished with radiating, muscular fibers, which change the form or position of the lens so as to adapt it to see with equal clearness objects at a distance or close by.

Another point that strikes the observer of the horse's eye is that in the darkness a bright, bluish tinge is reflected from the widely dilated pupil. This is due to the tapetum, a layer of nonpigmented tissue in the choroid coat inside the upper part of the eyeball, which

enables the animal to see and advance with security in darkness. The lower part of the cavity of the horse's eye, into which the dazzling rays of light fall, is furnished with an intensely black lining, by which the rays penetrating the inner nervous layer are instantly absorbed.

MUSCLES OF THE EYE

These consist of four straight muscles, two oblique, and one retractor. The straight muscles pass from the depth of the orbit forward on the inner, outer, upper, and lower sides of the eyeball and are fixed to the anterior portion of the fibrous coat, or sclera, so that in contracting singly they respectively turn the eye inward, outward, upward, and downward. When all act together they draw the eyeball deeply into its socket. The retractor muscle also consists of four muscular slips, repeating the straight muscles on a smaller scale, but as they are attached only on the back part of the eyeball they are less adapted to roll the eye than to draw it down into its socket. The two oblique muscles rotate the eye on its own axis, the upper one turning its outer surface upward and inward, and the lower one turning it downward and inward.

THE HAW (WINKING CARTILAGE, OR CARTILAGO NICTITANS)

This is a structure that, like the retractor muscle, is not found in the eye of man, but it serves in the lower animals to assist in removing foreign bodies from the front of the eyeball. It consists, in the horse, of a cartilage of irregular form, thickened inferiorly and posteriorly where it is intimately connected with the muscles of the eyeball and the fatty material around them, and expanded and flattened anteriorly where its upper surface is concave, and, as it were, molded on the lower and inner surface of the eyeball. Externally it is covered by the mucous membrane that lines the eyelids and extends over the front of the eye. In the ordinary restful state of the eye the edge of this cartilage should appear as a thin fold of membrane at the inner angle of the eye, but when the eyeball is drawn deeply into the orbit the cartilage is pushed forward, outward, and upward over it until the entire globe may be hidden from sight. This protrusion of the cartilage to cover the eye may be induced in the healthy eye by pressing the finger and thumb on the upper and lower lids, to cause retraction of the eyeball into the socket. When foreign bodies, such as sand, dust, chaff, or other irritants, have fallen on the eyeball or eyelids, it is similarly projected to push them off, their expulsion being further favored by a profuse flow of tears.

This is seen, to a lesser extent, in all painful inflammations of the eye, and to a very marked degree in lockjaw, when the spasm of the muscles of the eyeball draws the latter deeply into the orbit and pro-

jects forward the masses of fat and the cartilage. The practice of cutting off this apparatus whenever it is projected is brutal as the appendage is of great use to the animal. That the cartilage and membrane may become the seat of disease is undeniable, but so long as its edge is thin and even and its surface smooth and regular the mere fact of its projection over a portion of the eyeball is no evidence of disease in its substance, nor any warrant for its removal. It is usually only the evidence of the presence of pain in another part of the eye. For diseases of the cartilage itself, see Encephaloid Cancer.

LACHRYMAL APPARATUS

This consists (1) of a gland for the secretion of the tears and (2) of a series of canals for the conveyance of the superfluous tears into the cavity of the nose.

The gland is situated above the outer part of the eyeball, and the tears that have flowed over the eye and reached the inner angle are there directed by a small, conical papilla (lachrymal caruncle) into two minute orifices, and thence by two ducts (lachrymal) to a small pouch (lachrymal sac) from which a canal leads through the bones of the face into the nose. This opens in the lower part of the nose on the floor of the passage and a little outside the line of union of the skin that lines the false nostril with the mucous membrane of the nose. In the ass and mule this opening is situated on the roof instead of the floor of the nose but still close to the external opening.

EXAMINATION OF THE EYE

The eye, and to a certain extent the mucous membrane lining the eyelids, may be exposed to view by gently parting the eyelids with the thumb and forefinger pressed on the middle of the respective lids. The pressure, it is true, causes the protrusion of the haw over a portion of the lower and inner part of the eye, but by gentleness and careful graduation of the pressure this may be kept within bounds, and oftentimes even the interior of the eye can be seen. As a rule it is best to use the right hand for the left eye, and the left hand for the right, the finger in each case being pressed on the upper lid while the thumb depresses the lower one. In cases in which it is desirable to examine the inner side of the eyelid further than is possible by the above means, the upper lid may be drawn down by the eyelashes with the one hand and then everted over the tip of the forefinger of the other hand, or over a probe laid flat against the middle of the lid. When the interior of the eye must be examined it is useless to make the attempt in the open sunshine or under a clear sky. The worst cases, it is true, can be seen under such circumstances, but for the slighter forms the horse should be taken indoors, where all light from above will be shut off, and should be placed so that the light may fall on the eye from the front and side.

Then the observer, placing himself in front of the animal, will receive the reflected rays from the cornea, the front of the lens and the back, and can much more easily detect any cloudiness, opacity, or lack of transparency. The examination can be made much more satisfactorily by placing the horse in a dark chamber and illuminating the eye by a lamp placed forward and outward from the eye that is to be examined. Any cloudiness is thus easily detected, and any doubt may be resolved by moving the lamp so that the image of the flame may be passed in succession over the whole surface of the transparent cornea and of the crystalline lens. Three images of the flame will be seen, the larger one upright, reflected from the anterior surface of the eye; a smaller one upright, reflected from the anterior surface of the lens; and a second small one inverted from the back surface of the lens.

As long as these images are reflected from healthy surfaces they will be clear and perfect in outline, but as soon as one strikes on an area of opacity, it will become diffused, cloudy, and indefinite. Thus, if the large, upright image becomes hazy and imperfect over a particular spot of the cornea, that will be found to be the seat of disease and opacity. Should the large image remain clear, but the small upright one become diffuse and indefinite over a given point, it indicates opacity on the front of the capsule of the lens. If both upright images remain clear but the inverted one becomes indistinct at a given point, then the opacity is in the substance of the lens itself or in the posterior part of its capsule.

If in a given case the pupil remains so closely contracted that the deeper parts of the eye cannot be seen, a 1-percent solution of atropine sulfate may be instilled into the conjunctival sac and in a short time the pupil will be widely dilated.

DISEASES OF THE EYELIDS

CONGENITAL DISORDERS

Some faulty conditions of the eyelids are congenital, as division of an eyelid in two, after the manner of harelip, abnormally small opening between the lids, often connected with imperfect development of the eye, and closure of the lids by adhesion. The first may be remedied by paring the edges of the division and then bringing them together, as in torn lids. The last two, if remediable, require separation by the knife and subsequent treatment with a cooling astringent eyewash.

NERVOUS DISORDERS

Spasm of the eyelids may be due to constitutional susceptibility and/or to the presence of local irritants, such as insects, chemical irritants, sand, in the eye, to wounds or inflammation of the mucous

membrane, or to disease of the brain. When due to local irritation it may be temporarily overcome by instilling a few drops of a 1 percent solution of procaine hydrochloride into the eye, when the true cause may be ascertained and removed. The nervous or constitutional disease must be treated according to its nature.

Drooping eyelids, or ptosis, is usually present in the upper lid, or it is at least little noticed in the lower. It is sometimes only a symptom of paralysis of one-half of the face, in which case the ear, lips, and nostrils on the same side will be soft, drooping, and inactive, and even the half of the tongue may be paralyzed. If the same condition exists on both sides, there is difficult, snuffling breathing, from the air drawing in the flaps of the nostrils in inspiration, and all feed is taken in by the teeth, as the lips are useless. In both there is a free discharge of saliva from the mouth during mastication. This paralysis is a frequent result of injury to the seventh nerve, as it passes over the back of the lower jaw. In some cases the paralysis is confined to the lid, the injury having been sustained by the muscles that raise it, or by the supraorbital nerve, which emerges from the bone just above the eye. Such injury to the nerve may have resulted from fracture of the orbital process of the frontal bone above the eyeball.

The condition, however, may be due to spasm of the sphincter muscle, which closes the lids, or to inflammation of the upper lid, usually a result of blows on the orbit. In the latter case it may run a slow course with chronic thickening of the lid.

The paralysis due to injury may be often remedied, (1) by the removal of any remaining inflammation by a wet sponge worn beneath the ear and kept in place by a bandage; (2) when all inflammation has passed, by a blistering agent on the same region or by rubbing it daily with a mixture of olive oil and strong aqua ammonia in equal proportions. Improvement is usually slow, and it may be months before complete recovery ensues.

In paralysis from blows above the eyes the same treatment may be applied to that part.

Thickening of the lid may be treated by painting with tincture of iodine, and if this treatment is not successful, by surgical removal of an elliptical strip of the skin from the middle of the upper lid and stitching the edges together.

INFLAMMATION OF THE EYELIDS

The eyelids suffer more or less in all severe inflammations of the eye, whether external or internal, but inasmuch as the disease sometimes begins in the lids and at other times is exclusively confined to them, it deserves special mention.

Among the causes are: Exposure to drafts of cold air or to cold rain or snowstorms; the bites or stings of mosquitoes, flies, or other insects; snake bites, pricks with thorns, blows of a whip or club; accidental bruises against the stall or ground, especially during the violent struggles of colic, enteritis, phrenitis (staggers), and when thrown for operations. It is also a result of infecting inoculations, as of erysipelas, anthrax, or boils, and is noted by Leblanc as especially prevalent among horses kept on low, marshy pastures. Finally, the introduction of sand, dust, chaff, beards of barley and seeds of the finest grasses, and the contact with irritant, chemical powders, liquids, and gases (ammonia from manure or a factory, chlorine, strong sulfur fumes, smoke, and other products of combustion) may start the inflammation. The eyelids often undergo extreme inflammatory and dropsical swelling in urticaria (nettle rash, surfeit) and in the general inflammatory dropsy known as purpura hemorrhagica.

Inflammations of the eyelids, therefore, are due to one of three causes: Constitutional causes; direct injury, mechanical or chemical; or inoculation with infecting material.

Inflammations due to constitutional causes are distinguished by the absence of any local wound and by the history of a low, damp pasture, exposure, indigestion from unwholesome feed, or the presence elsewhere on the legs or body of the general, doughy swellings of purpura hemorrhagica. The lids are swollen and thickened; the degree may be slight or so extreme that the eyeball cannot be seen. If the lid can be everted to show its mucous membrane, that is seen to be of a deep-red color, especially along the branching lines of the blood vessels. The part is hot and painful, and a profuse flow of tears and mucus escapes on the side of the face, causing irritation and loss of the hair. If improvement follows, this discharge becomes more tenacious and tends to cause adhesion of the edges of the upper and lower lids and to mat together the eyelashes in bundles. This gradually decreases to the natural quantity, and the redness and congested appearance of the eye disappears, but swelling, thickening, and stiffness of the lids may continue for a time. There may be more or less fever according to the violence of the inflammation, but as long as there is no serious disease of the interior of the eye or of other vital organ, it is usually moderate.

The local treatment consists in astringent, soothing lotions applied with a soft cloth kept wet with the lotion and hung over the eye by tying it to the headstall of the bridle on the two sides. If the mucous-membrane lining of the lids is the seat of little red granular elevations, a drop of solution of 2 grains of nitrate of silver in an ounce of distilled water should be applied with the soft end of a clean feather to the inside of the lid twice a day. The patient should be removed from

all such conditions (pasture, faulty feed, exposure, etc.) as may have caused or aggravated the disease, and from dust and irritant fumes and gases. The animal should be fed from a manger high enough to favor the return of blood from the head and should be kept from work, especially in a tight collar that would prevent the descent of blood by the jugular veins. The diet should be laxative and non-stimulating (grass, bran mash, carrots, turnips, beets, potatoes, or steamed hay), and any constipation should be corrected by a mild dose of raw linseed oil (1 to 1½ pints). In cold weather warm blanket-ing may be necessary, and even loose flannel bandages to the legs, but heat should never be sought at the expense of pure air.

In inflammations due to local irritants of a noninfective kind a careful examination will usually reveal their presence, and the first step must be their removal with a pair of blunt forceps or the point of a lead pencil. Subsequent treatment will be in the main the local treatment just advised.

In infective inflammation there will often be found a prick or tear by which the septic matter has entered, and in such case the inflammation for a time will be concentrated at that point. A round or conical swelling around an insect bite is especially characteristic. A snake bite is marked by the double prick made by the two teeth and by the violent and rapidly spreading inflammation. Erysipelas is attended with much swelling, extending beyond the lids and causing the mucous membrane to protrude beyond the edge of the eyelid (chemosis). This is characterized by a bright, uniform, rosy red, disappearing on pressure, or later by a dark, livid hue, but with less branching redness than in noninfective inflammation and less of the dark, dusky, brownish or yellowish tint of anthrax. Little vesicles may appear on the skin, and pus may be found without any distinct limiting membrane, as in abscess. It is early attended with high fever and marked general weakness and lack of appetite. Anthrax of the lids is marked by a firm swelling, surmounted by a blister with bloody serous contents, which tends to burst and dry up into a slough, the surrounding parts become involved in the same way. Or it may show as a diffuse, dropsical swelling, with less of the hard, central sloughing nodule, but, like that, tending to spread quickly. In both cases alike the mucous membrane and the skin, if white, assume a dusky-brown or yellowish-brown hue, which is largely characteristic. This may pass into a black color by reason of extravasation of blood. Great constitutional disturbance appears early, with much prostration and weakness and generalized anthrax symptoms.

Treatment.—The treatment will vary according to the severity. Insect bites may be touched with a solution of equal parts of glycerin and aqua ammonia, or a 5-percent solution of phenol in water. Snake

bites may be bathed with aqua ammonia and the same agent given in doses of 2 teaspoonfuls in a quart of water.

If anthrax infection is suspected, immediate assistance of a competent veterinarian should be obtained. In the early stages of anthrax infection the subcutaneous and intravenous injection of large doses of antianthrax serum (50 to 100 cubic centimeters) is recommended. Prevent spreading the disease to other animals and man by isolation of the affected animals, rigid sanitary precautions, and disinfection of infected quarters.

STY, OR FURUNCLE (BOIL), OF THE EYELID

This is an inflammation of limited extent, advancing to the formation of pus and the sloughing out of a small mass of the natural tissue of the eyelid. It forms a firm, rounded swelling, usually near the margin of the lid, which suppurates and bursts in 4 or 5 days. Its course may be hastened by a poultice made of bran, to which has been added a few drops of liquefied phenol, the whole applied in a very thin muslin bag. If the swelling is slow to open after having become yellowish white, it may be opened by a lancet, the incision being made at right angles to the margin of the lid.

ENTROPION AND ECTROPION (INVERSION AND EVERSION OF THE EYELID)

These are caused by wounds, sloughs, ulcers, or other causes of loss of substance of the mucous membrane on the inside of the lid and of the skin on the outside; also by tumors, skin diseases, or paralysis that leads to displacement of the margin of the eyelid. As a rule, they require a surgical operation, with removal of an elliptical portion of the mucous membrane or skin, as the case may be. This operation should be performed only by a skilled veterinary surgeon.

TRICHIASIS

This consists in the turning in of the eyelashes so as to irritate the front of the eye. If a single eyelash is involved, it may be snipped off with scissors close to the margin of the eyelid or pulled out by the root with a pair of flat-bladed forceps. If the divergent lashes are more numerous, the treatment may be as for entropion, by excising an elliptical portion of skin opposite the offending lashes and stitching the edges together, to draw outward the margin of the lid at that point.

WARTS AND OTHER TUMORS OF THE EYELIDS

The eyelids form a common site for tumors, and above all, warts, which consist in a simple diseased overgrowth (hypertrophy) of the surface layers of the skin. If small, they may be snipped off with scissors or tied around the neck with a stout, waxed thread and left to drop off, the destruction being completed, if necessary, by the

daily application of a piece of copper sulfate (blue vitriol), until any unhealthy material has been removed. If more widely spread, the wart may still be clipped off with curved scissors or knife, and the caustic thoroughly applied day by day.

A vascular wart containing much blood is more apt to bleed and is best removed by constricting its neck with a waxed cord or rubber band, or if too broad it may be transfixed through its base by a needle with a double thread, which is then to be cut in two and tied around the two portions of the neck of the tumor. If still broader, the needle, similarly threaded, may be carried through the base of the tumor at regular intervals, so that the whole may be tied in moderately sized sections.

In gray and in white horses, black, pigmentary tumors (melanoma) are common on the black portions of skin, such as the eyelids, and are to be removed by scissors or knife, according to their size. In the horse they do not usually recur when completely removed, but at times they prove malignant (as is the rule in man), and then they tend to reappear in the same site or in internal organs with possible fatal effect.

Encysted, honeylike (melicerous), sebaceous, and fibrous tumors of the lids require removal with the knife.

TORN EYELIDS OR WOUNDS OF EYELIDS

Eyelids are sometimes torn by the horns of cattle, by the teeth of aggressive animals, or by getting caught on nails in the stall, rack, or manger, on the point of stumps, fences or fence rails, on the barbs of wire fences, and on other pointed bodies. The edges should be brought together as promptly as possible, to effect union without the formation of pus, puckering of the skin, and unsightly distortions. Great care is necessary to bring the two edges together evenly without twisting or puckering. The simplest mode of holding them together is by a series of sharp pins passed through the lips of the wound at intervals of not more than a third of an inch, and held together by a thread twisted around each pin in the form of the figure 8, and carried obliquely from pin to pin in two directions, to prevent gaping of the wound in the intervals. The points of the pins may then be cut off with snips, and the wound may be wet twice a day with a weak solution of phenol.

TUMOR OF THE HAW (CARIES OF THE CARTILAGE)

Though the haw, even when perfectly healthy, is sometimes cruelly excised for alleged "hooks," in the various diseases that lead to retraction of the eye into its socket, the haw itself, like other bodily structures, may be the seat of actual disease. The pigmentary, black tumors of white horses and cancer may attack this part primarily or

extend to it from the eyeball or eyelids; hairs have been found growing from its surface, and the mucous membrane covering it becomes inflamed in common with that covering the front of the eye. These inflammations are but a phase of the inflammation of the external structures of the eye and require no special treatment. The tumors lead to such irregular enlargement and distortion of the haw that the condition must not be confused with the simple projection of the healthy structure over the eye when the lids are pushed apart with the finger and thumb, and the same remark applies to the ulceration, or caries, of the cartilage. In the latter case, besides the swelling and distortion of the haw, there is this peculiarity, that in the midst of the red inflamed mass there appears a white line or mass formed by the exposed edge of the ulcerating cartilage. The animal having been thrown and properly restrained, an assistant holds the eyelids apart while the operator seizes the haw with forceps or hook and carefully dissects it out with blunt-pointed scissors. The eye is then covered with a cloth, kept wet with an eyewash, as for external ophthalmia. Local anesthesia should be employed to desensitize the structures before operation.

OBSTRUCTION OF THE LACHRYMAL APPARATUS (WATERING EYE)

The escape of tears on the side of the cheek is a symptom of external inflammation of the eye, but it may also occur from any disease of the lachrymal apparatus that interferes with the normal progress of the tears to the nose; hence, in all cases when this symptom is not attended with special redness or swelling of the eyelids, it is well to examine the lachrymal apparatus. In some instances the orifice of the lachrymal duct on the floor of the nasal chamber and close to its anterior outlet will be blocked by a portion of dry mucopurulent exudate, on the removal of which tears may begin to escape. This implies an inflammation of the canal, which may be treated by occasional sponging out of the nose with warm water and the application of the same on the face. Another remedy is to feed warm mash of wheat bran from a nosebag, so that the relaxing effects of the water vapor may be obtained.

The two lachrymal openings, situated at the inner angle of the eye, may fail to admit the tears by reason of their deviation outward in connection with the eversion of the lower lid or by reason of their constriction in inflammation of the mucous membrane. The lachrymal sac, into which the lachrymal ducts open, may fail to discharge its contents by reason of constriction or closure of the duct leading to the nose, and it then forms a rounded swelling beneath the inner angle of the eye. The duct leading from the sac to the nose may be compressed or obliterated by fractures of the bones of the face and in disease of

these bones (osteosarcoma, so-called osteoporosis, diseased teeth, glanders of the nasal sinuses, abscess of the same cavities).

The narrowed or obstructed ducts may be made pervious by a fine, silver probe passed down to the lachrymal sac, and any existing inflammation of the passages may be counteracted by the use of steaming mashies of wheat bran, by fomentations or wet cloths over the face and even by the use of astringent eyewashes and the injection of similar liquids into the lachrymal canal from its nasal opening. The ordinary eyewash may be used for this purpose, or it may be injected after dilution to half its strength. The fractures and diseases of the bones and teeth must be treated according to their special requirements when, if the canal is still left pervious, it may be again rendered useful.

EXTERNAL OPHTHALMIA (CONJUNCTIVITIS)

In inflammation of the outer parts of the eyeball, the exposed vascular and sensitive mucous membrane (conjunctiva) that covers the ball, eyelids, haw, and lachrymal apparatus is usually most prominently involved, yet adjacent parts are more or less implicated, and when disease is concentrated on these contiguous parts it constitutes a phase of external ophthalmia that requires special attention. This has already been discussed.

Causes.—The causes of external ophthalmia are mainly those that act locally—blows with whips, clubs, and twigs; the presence of foreign bodies, such as hayseed, chaff, dust, lime, sand, snuff, or pollen of plants, or flies attracted by the brilliancy of the eye; wounds of the bridle; the migration of the scabies (mange) mite into the eye; smoke; ammonia arising from the excretions; or irritant emanations from drying marshes. Road dust containing infecting microbes is a common factor. A very dry air is alleged to act injuriously by drying the eye as well as by favoring the production of irritant dust. The undue exposure to bright sunshine through a window in front of the stall, or to the reflection from snow or water, also is undoubtedly injurious. The unprotected exposure of the eyes to sunshine through the use of a very short overdraw check is to be condemned, and the keeping of the horse in a dark stall, from which it is habitually led into the glare of full sunlight, intensified by reflection from snow or white limestone, is a locally acting cause. Exposure to cold, rain, wet snowstorms, cold drafts, and wet quarters are also causes of conjunctivitis, the general disorder which they produce affecting the eye, if that happens to be the weakest and most susceptible organ of the body, or if it has been subjected to any special local injury, such as dust, irritant gases, or excess of light. Again, external ophthalmia is a constant concomitant of inflammation of the contiguous and continuous mucous membranes of the nose and throat—

hence the red, watery eyes in connection with nasal catarrh, sore throat, influenza, strangles, nasal glanders, and the like. In such cases, however, the affection of the eye is subsidiary and is manifestly overshadowed by the primary and predominating disease.

Symptoms.—The symptoms are watering of the eye, swollen lids, redness of the mucous membrane exposed by the separation of the lids—it may be a mere pink blush with more or less branching redness, or a deep, dark red, as from effusion of blood—and a bluish opacity of the cornea, which is normally clear and translucent. Except when resulting from wounds and actual extravasation of blood, however, the redness is superficial, and if the opacity is confined to the edges and does not involve the entire cornea, the aqueous humor behind is still clear and limpid. The fever is always less severe than in internal ophthalmia and is high only in the worst cases. The eyelids may be kept closed, the eyeball retracted, and the haw protruded over one-third or one-half of the ball, but this is due to the pain only and not to any excessive sensibility to light, as shown by the comparatively widely dilated pupil. In internal ophthalmia, on the contrary, the narrow, contracted pupil is an indication of pain caused by the falling of light on the inflamed and sensitive optic nerve (retina) and choroid.

If the affection has resulted from a wound of the cornea, not only is that the point of greatest opacity, forming a white speck or fleecy cloud, but often the blood vessels begin to extend from the adjacent covering of the eye (sclera) to the white spot, and that portion of the cornea is rendered permanently opaque. Again, if the wound has been severe, though still short of cutting into the anterior layers of the cornea, the injury may lead to ulceration that may penetrate more or less deeply and leave a breach in the tissue that, if filled up at all, is repaired by opaque fibrous tissue in place of the transparent original structure. Pus may form, and the cornea assumes a yellowish tinge and bursts, giving rise to a deep sore that is likely to extend as an ulcer and in its turn may be followed by bulging of the cornea at that point (staphyloma). This inflammation of the conjunctiva may be simply catarrhal, with profuse mucopurulent discharge; it may be granular, the surface being covered with minute reddish elevations; or it may become the seat of a false membrane.

Treatment.—In treating external ophthalmia the first object is the removal of the cause. Remove any dust, chaff, thorn, or other foreign body from the conjunctiva; purify the stable from all sources of ammoniacal or other irritant gas; keep the horse from dusty roads, and, above all, from the proximity of a leading wagon and its attendant cloud of dust; remove the animal from pasture and feed from a rack that is neither so high as to drop seeds, etc., into the eyes nor so low as to favor the accumulation of blood in the head; avoid equally excess

of light from a sunny window in front of the stall and excess of darkness from the absence of windows; keep the animal from cold drafts and rains and wet bedding, and apply curative measures for inflammation of the adjacent mucous membranes or skin. If the irritant has been of a caustic nature, remove any remnant of it by persistent bathing with tepid water and a soft sponge or with water mixed with white of egg, or a glass filled with the liquid may be inverted over the eye so that its contents may dilute and remove the irritant. If the suffering is severe, a lotion with a few grains of atropine sulfate in an ounce of water may be applied.

In strong, vigorous patients benefit will usually be obtained from a laxative, such as 2 tablespoonfuls of Glauber's salt daily. As local applications, astringent solutions are usually the best, as 30 grains of borax or of zinc sulfate in a quart of water, to be applied constantly on a cloth as advised under Inflammation of the Eyelids. In the absence of anything better, cold water may serve the purpose. Above all, adhesive and oily agents (molasses, sugar, fats) are to be avoided, as they serve only to irritate.

WHITE SPECKS AND CLOUDINESS OF THE CORNEA

As a result of external ophthalmia, opaque specks, clouds, or haziness are often left on the cornea. To remove these, it is necessary to touch them daily with a soft feather dipped in a solution of 3 grains of silver nitrate in 1 ounce of distilled water. This should be applied until all inflammation has subsided and until its contact is comparatively painless. It is rarely successful with an old, thick scar following an ulcer nor with an opacity having red blood vessels running across it.

ULCERS OF THE CORNEA

These may be treated with silver nitrate lotion of twice the strength used for opacities. Powdered gentian, one-half ounce, and iron sulfate, one-fourth ounce, daily, may improve the general health and increase the reparatory power.

INTERNAL OPHTHALMIA (IRITIS, CHOROIDITIS, AND RETINITIS)

Although inflammations of the iris, choroid, and retina—the inner, vascular, and nervous coats of the eye—occur to a certain extent independently of one another, one usually supervenes upon the other, and, as the symptoms are thus made to coincide, it will be best for our present purposes to treat the three as one disease.

Causes.—The causes of internal ophthalmia are largely those of the external form only, acting with greater intensity or on a more susceptible eye. Severe blows, bruises, punctures, etc., of the eye, the penetration of foreign bodies into the eye (thorns, splinters of iron,

etc.), sudden transition from a dark stall to bright sunshine, to the glare of snow or water, constant glare from a sunny window, abuse of the overdraw checkrein, vivid lightning flashes, drafts of cold, damp air; above all, when the animal is perspiring, exposure to cold rain or snowstorms, swimming cold rivers; also certain general diseases such as rheumatism, arthritis, influenza, and disorders of the digestive organs, may become complicated by this affection. From the close relation between the brain and eye—alike in the blood vessels and nerves—disorders of the first lead to affection of the second, and the same remark applies to the persistent irritation to which the jaws are subjected in the course of dentition. So potent is the last agency that there is likelihood of a recurrence of ophthalmia as long as dentition is incomplete, and of immunity if the animal completes its dentition without any permanent structural change in the eye.

Symptoms.—The symptoms vary according to the cause. If the attack is due to direct physical injury, the inflammation of the eyelids and superficial structures may be quite as marked as that of the interior of the eye. If, on the other hand, the attack occurs from general causes or as a complication of some distant disease, the affection may be largely confined to the deeper structure, and the swelling, redness, and tenderness of the superficial structures will be less marked. When the external coats thus practically escape, the extreme anterior edge of the white coat or sclera, where it overlaps the border of the transparent cornea, is in a measure free from congestion, and, in the absence of the obscuring dark pigment, forms a whitish ring around the cornea. This is partly due to the fact that a series of arteries (ciliary) passing to the inflamed iris penetrate the sclera a short distance behind its anterior border, and there is therefore a marked difference in color between the general sclera containing these congested vessels and the anterior rim from which they are absent. Unfortunately, the pigment is often so abundant in the anterior part of the sclera as to hide this symptom. In internal ophthalmia the opacity of the cornea may be confined to a zone around the outer margin of the cornea, and even this may be a bluish haze rather than a deep, fleecy white. In consequence it becomes impossible to see the interior of the anterior chamber for the aqueous humor and the condition of the iris and pupil. The aqueous humor is usually turbid and has numerous yellowish-white flakes floating in its substance or deposited in the lower part of the chamber, so as to cut off the view of the lower portion of the iris. The still visible portion of the iris has lost its natural, clear, dark luster, which is replaced by a brownish or yellowish sereleaf color. This is more marked in proportion as the iris is inflamed, and less so as the inflammation is confined to the choroid. The quantity of flocculent deposit in the chamber of the aqueous humor is also in direct ratio to the inflammation of the iris. Perhaps the

most marked feature of internal ophthalmia is the extreme and painful sensitiveness to light. On this account the lids are usually closed, but when opened the pupil is seen to be narrowly closed, even if the animal has been kept in a darkened stall. Exceptions to this are seen when inflammatory effusion has overfilled the globe of the eye and by pressure of the retina has paralyzed it, or when the exudation into the substance of the retina itself has similarly led to its paralysis. Then the pupil may be dilated, and frequently its margin loses its regular, ovoid outline and becomes uneven by reason of the adhesions that it has contracted with the capsule of the lens, through its inflammatory exudations. In excessive effusion into the globe of the eye causing it to become so tense and hard that it cannot be indented with the tip of the finger, paralysis of the retina is likely to result. With such paralysis of the retina, vision is heavily clouded or entirely lost; hence, in spite of the open pupil, the finger may be approached to the eye without the animal's becoming conscious of it until it touches the surface, and if the nose on the affected side is gently struck and a feint made to repeat the blow the patient makes no effort to evade it. Sometimes the edges of the contracted pupil become adherent to each other by an intervening plastic exudation, and the opening becomes virtually abolished. In severe inflammations pus may form in the choroid or iris, and escaping into the cavity of the aqueous humor show as a yellowish-white stratum below. In nearly all cases there is resulting degeneration of the lens and its capsule, constituting a cloudiness or opacity (cataract), which in severe and long-standing cases appears as a white, fleecy mass behind a widely dilated pupil. In the slighter cases cataract can be recognized by examination of the eye in a dark chamber, with an oblique side light, as described in the introduction to this article. Black cataracts are formed by the adhesion of the pigment on the back of the iris to the front of the lens and by the subsequent tearing loose of the iris, leaving a portion of its pigment adherent to the capsule of the lens. If the pupil is so contracted that it is impossible to see the lens, it may be dilated by applying to the front of the eye with a feather some drops of a solution of 4 grains of atropine sulfate in an ounce of water.

Treatment.—The treatment of internal ophthalmia should include first, the removal of all existing causes or sources of aggravation of the disease, which need not be repeated here. Special care to protect the patient against strong light, cold, wet weather, and active exertion must, however, be insisted on. A dark stall and a cloth hung over the eye are important, and cleanliness, warmth, dryness, and rest are equally necessary.

Locally the astringent lotions advised for external ophthalmia may be resorted to, especially when the superficial inflammation is well

marked. More important, however, is to instill into the eye, a few drops at a time, a solution of 4 grains of atropine sulfate in 1 ounce of distilled water. This may be effected with the aid of a soft feather and may be repeated at intervals of 10 minutes until the pupil is widely dilated. As the horse is to be kept in a dark stall, the consequent admission of light will be harmless, and the dilation of the pupil prevents adhesion between the iris and lens, relieves the constant tension of the eye in the effort to adapt the pupil to the light, and aids in the contraction of the blood vessels of the eye and the lessening of congestion, exudation, and intraocular pressure. Another local measure is a blistering agent, which may be applied to the side of the nose or beneath the ear.

A moderate quantity of an easily digestible diet, such as bran mash, middlings, grass, or steamed hay, should be fed throughout.

Even after the active inflammation has subsided the atropine sulfate lotion should be continued for several weeks to keep the eye in a state of rest, and during this period the patient should be kept in semidarkness or taken out only with a dark shade over the eye. For the same reason heavy drafts and rapid paces, which would cause congestion of the head, should be carefully avoided.

PERIODIC OPHTHALMIA (RECURRENT OPHTHALMIA, MOON BLINDNESS)

Periodic ophthalmia is an inflammatory affection of the eyes of horses and mules and is characterized by a strong tendency to recur again and again. It usually terminates in blindness.

Cause.—Although much study has been given to this disease, the cause has not yet been definitely determined.

It has long been observed that periodic ophthalmia is closely associated with low marshy soils and the forage produced from such soils, as well as wet climates. Dark, damp, and poorly ventilated stables are notoriously favorable sites for the disease to make its appearance and persist for many years. In some stables of this character it has been impossible to keep horses for periods of 6 months to a year without their developing periodic ophthalmia, and for the most part these animals ultimately go blind in one or both eyes. On the other hand, high, dry lands and dry, light, ventilated stables seem to fortify horses and mules against this disease. It has been repeatedly observed that animals affected with the disease, when removed from the dark, damp, or poorly ventilated stables to good environment, have no further attacks.

Heredity has been considered by many persons as being a factor in the continuance of the disease. Just what influence, if any, heredity may have remains to be proved. Many cases have been noted in

which heredity apparently was not a factor in disposing to or continuing the disease.

Symptoms.—Animals of any age may become affected with this disease, but most cases occur in animals from 2 to 6 years of age. The onset of an attack of this specific disease of the eye is sudden. Frequently animals are found in the morning with a greatly swollen, weeping, and almost closed eye, whereas the night before they were normal. The affected eye is sensitive to the touch and to light. Frequently there are a rise of body temperature, general dépression, and impairment of appetite.

Opacity of the cornea soon becomes apparent, the clearness of the cornea having changed to a bluish cast. This cloudiness may increase in intensity until the entire cornea becomes milky white in appearance. Before it becomes too opaque, the pupil is greatly contracted and whitish flakes may be seen floating in the watery fluid of the anterior chamber of the eye. The discharge is profuse and rapidly changes from a watery consistence to that of a thin, sticky pus. After a few days' to a week's duration the inflammation begins to subside, the eyelids are held more widely open, the discharge becomes less profuse, and the opacity of the cornea gradually diminishes. Usually at the end of the second week the acute inflammation has completely subsided, but the vital structures of the eye are left with more or less damage that is permanent. Sometimes a single attack results in a completely blind eye attended with varying degrees of opacity. Again an animal may have more than one attack before complete blindness ensues, but each attack leaves its additional damage to the vital structures. The disease process may then extend to the opposite eye with the same results.

After an animal has had one or more attacks the eyeball becomes perceptibly smaller than normal and the upper eyelid, in place of presenting a continuous arch, has about one third from its inner angle an abrupt bend or notch that is characteristic of the condition. Discolorations of the cornea range from bluish to milky white, and the pupil remains somewhat contracted except when the lens is opaque, in which case it is widely dilated. If, as is common, one eye only has suffered, the contrast with the sound eye is all the more pronounced. Another feature is the erect, attentive carriage of the ear, to compensate to some extent for the waning vision. The attacks vary greatly in severity in different cases, but the recurrence is characteristic, and all alike lead to permanent blindness.

Treatment.—Thus far no treatment has been found that can be considered a specific cure for periodic ophthalmia. Without medicinal interference, the acute inflammation that accompanies an attack of the disease will subside in 10 to 14 days although more or less permanent damage to the eye invariably has taken place. Furthermore, the

initial attack is usually followed sooner or later by further attacks in spite of any treatment that may be given. Although there is no treatment available that affects a permanent cure, measures can be taken to minimize the damage done to the eye and thereby prolong the usefulness of the animal. When the disease is first noticed the animal should be placed at rest in comfortable quarters that are partially darkened. The eye should be bathed frequently with a suitable collyrium, such as a 5-percent solution of boric acid or a $\frac{1}{2}$ -percent solution of zinc sulfate. The pupil should be kept dilated by instilling into the eye several times daily a few drops of a 1-percent atropine sulfate solution. The pain that accompanies the acute inflammatory process may be relieved by instillations of several drops of a 1-percent solution of procaine into the eye several times daily. The animal should not be put to work or exposed to full light until the acute attack has completely subsided.

Prevention.—In the absence of definite knowledge as to the real cause of periodic ophthalmia, no specific preventive treatment has been developed. To control the disease, steps should be taken to eliminate as far as possible those factors that are known to be associated with the trouble and that therefore might be termed contributing factors.

CATARACT

Cataract is frequently the result of internal ophthalmia, as well as of periodic ophthalmia. The offensive appearance of cataract may be obviated by extraction or depression of the lens, but as the rays of light would no longer be properly refracted, perfect vision would not be restored, and the animal would be likely to become an inveterate shy. If total blindness continued by reason of a damaged retina, no shyng would result.

PARALYSIS OF THE NERVE OF SIGHT (AMAUROSIS)

Causes.—The causes of this affection are tumors or other disease of the brain implicating the roots of the optic nerve, injury to the nerve between the brain and eye, and inflammation of the optic nerve within the eye (retina), or undue pressure on the same from drop-sical or inflammatory effusion. It may also occur from an overloaded stomach, from profuse bleeding, and even from the pressure of the gravid womb in gestation.

Symptoms.—The symptoms are wide dilatation of the pupils so as to expose fully the interior of the globe, the expansion remaining the same in light and darkness. In healthy eyes, when exposed to the light, the pupils suddenly contract and then dilate and contract alternately until they adapt themselves to the light. In paralysis of the nerves of sight, the horse does not swerve when a feint to strike is

made unless the hand causes a current of air. The ears are held erect, turn quickly towards any noise, and the horse steps high to avoid stumbling over objects that it cannot see.

Treatment.—This is useful only when the disease is symptomatic of some removable cause, such as congested brain, overloaded stomach, or gravid womb.

TUMORS OF THE EYEBALL

A variety of tumors involve the eyeball—dermoid, papillary, fatty, cystic, and melanotic—but perhaps the most frequent in the horse is encephaloid cancer. This may grow in or on the globe, haw, eyelid, or bones of the orbit and can be remedied, if at all, only by early and thorough excision. It may be distinguished from the less dangerous tumors by its softness, friability, and great vascularity, bleeding on the slightest touch, as well as by its anatomical structure.

STAPHYLOMA

This consists in a bulging forward of the cornea at a given point by the sacculate yielding and distension of its coats, and it may be either transparent or opaque and vascular. In the last form the iris has become adherent to the back of the cornea, and the whole structure is filled with blood vessels. In the first form the bulging cornea is attenuated; in the last it may be thickened. The best treatment is by excision of a portion of the rise to relieve the intraocular pressure.

PARASITES IN THE EYE

Acari in the eye have been incidentally alluded to under inflammation of the lids.

Thelazia lacrymalis is a white worm, $\frac{1}{8}$ to 1 inch long, which inhabits the lachrymal duct and the underside of the eyelids and haw in the horse, producing a verminous conjunctivitis, sometimes with corneal ulcers. The first step in treatment in such cases is to remove the worm with forceps, then treat as for external inflammation. This worm occurs in Brazil, Europe, and India.

Setaria equina is a delicate, white, silvery worm which often attains a length of 2 inches (a length as great as 5 inches has been reported). It invades the aqueous humor, where its constant active movements make it an object of great interest, and it is frequently exhibited as a "snake in the eye." Hall states that this worm is normally a parasite of the peritoneal cavity and is probably transmitted from one horse to another by some biting insect that becomes infected by larvae in the blood. When present in the eye, it causes inflammation and must be removed through an incision made with a lancet in the upper border of the cornea close to the sclera, the point of the instru-

ment being directed slightly forward to avoid injury to the iris. Then cold water or astringent antiseptic lotions should be applied.

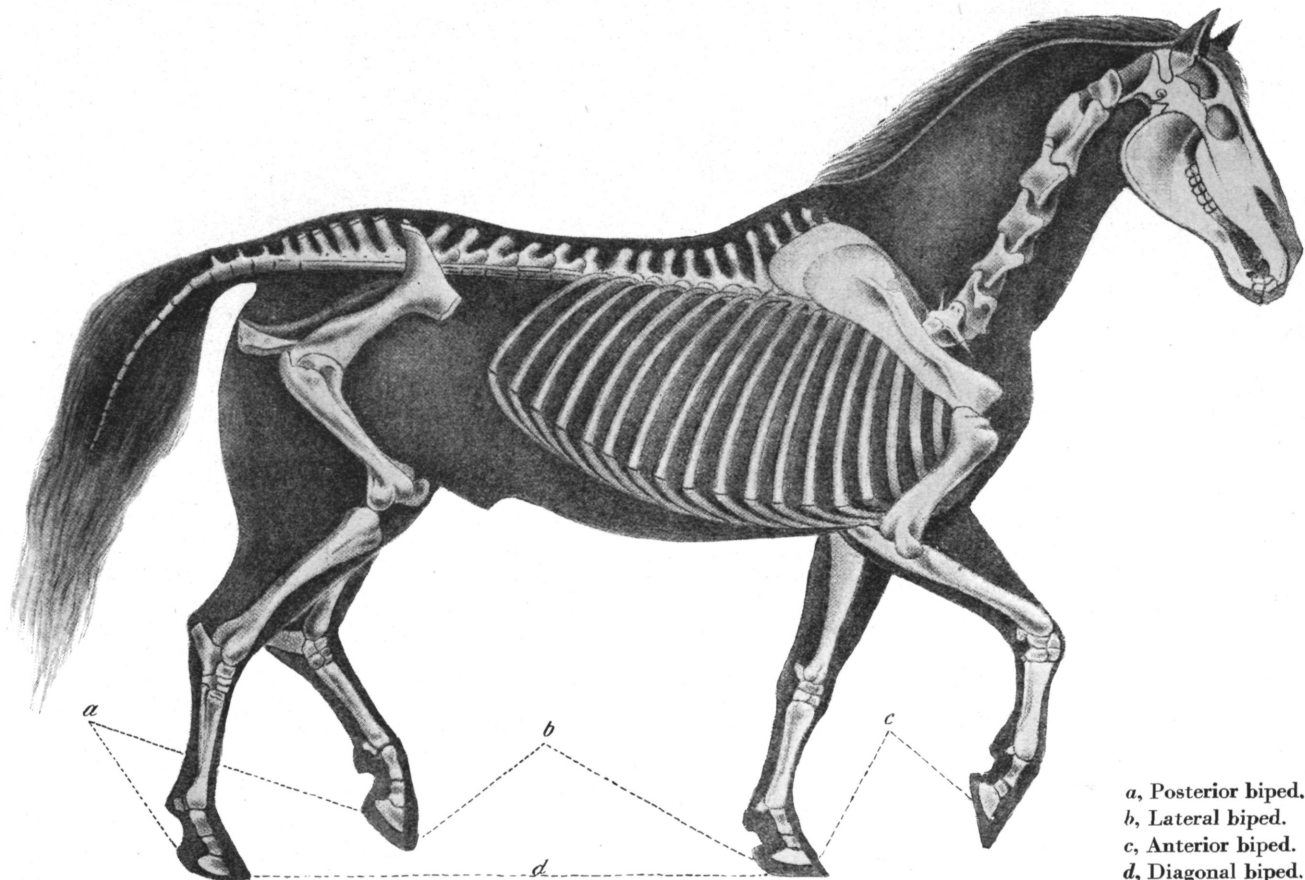
Setaria labiato papillosa, a form occurring as an adult in the peritoneal cavity of cattle, has been found as an immature form in the eyes of horses. The location of this worm and the injury produced by the infestation are similar in all respects to those mentioned for *S. equina*.

Filaria conjunctivae, resembling *Setaria equina* very much in size and general appearance, is another roundworm that has been found in the eye of the horse in Europe.

The echinococcus, the cystic or larval stage of the tapeworm of the dog, has been found in the eye of the horse, and a cysticercus is also reported.

NIGHT BLINDNESS (NYCTALOPIA)

Night blindness is a condition in which sight is normal by good illumination but deficient at night or with reduced illumination. It may result from disease of the retina, or it may occur in otherwise normal eyes from a deficiency of vitamin A in the diet of affected animals. In such cases the night blindness results from faulty nutrition of the retina. Vitamin A deficiency can be avoided by feeding good-quality hay that has not been leached or bleached in curing or by grazing on green pasture. When concentrates are fed, yellow corn may also be used as a source of vitamin A.



- a, Posterior biped.
b, Lateral biped.
c, Anterior biped.
d, Diagonal biped.

Haines, del. after Colin.

SKELETON OF HORSE.

Lameness: Its Causes and Treatment

By A. LIAUTARD, M. D., V. M.

[Revised by JOHN R. MOHLER, A. M., V. M. D., D. Sc.]

The function of locomotion is performed by the action of two principal systems of organs, known in anatomical and physiological terminology as passive and active, the muscles performing the active and the bones the passive portion of the movement. The necessary connection between the cooperating parts of the organism is effected by means of a vital contact by which the muscle is attached to the bone at certain determinate points. These points of attachment appear sometimes as an eminence, sometimes as a depression, sometimes a border or an angle, or again as a mere roughness. The necessary motion is provided for by the formation of the ends of the long bones into the requisite articulations, joints, or hinges. Every motion is the product of the contraction of one or more of the muscles, which, as it acts upon the bony levers, gives rise to a movement of extension or flexion, abduction or adduction, rotation or circumduction. The movement of abduction is that which passes from the median line, or the center of the body, and that of adduction, that which passes toward this line. The movements of flexion and extension are too well understood to need defining. It is the combination and rapid alterations of these movements that produce the different postures and various gaits of the animal, and it is their interruption and derangement, from whatever causes, that constitute the pathological condition known as lameness.

ANATOMY

The bones constitute the skeleton of the animal (pl. XXIII). They are of various forms, three of which—the long, the flat, and the small—are found in the extremities. These are more or less regular in their form but present on their surfaces a variety of aspects, exhibiting in turn, according to the requirement of each case, a roughened or smooth surface, variously marked with grooves, crests, eminences, and depressions, for the necessary muscular attachments, and, as before mentioned, are connected by articulations and joints, of which some are immovable and others movable.

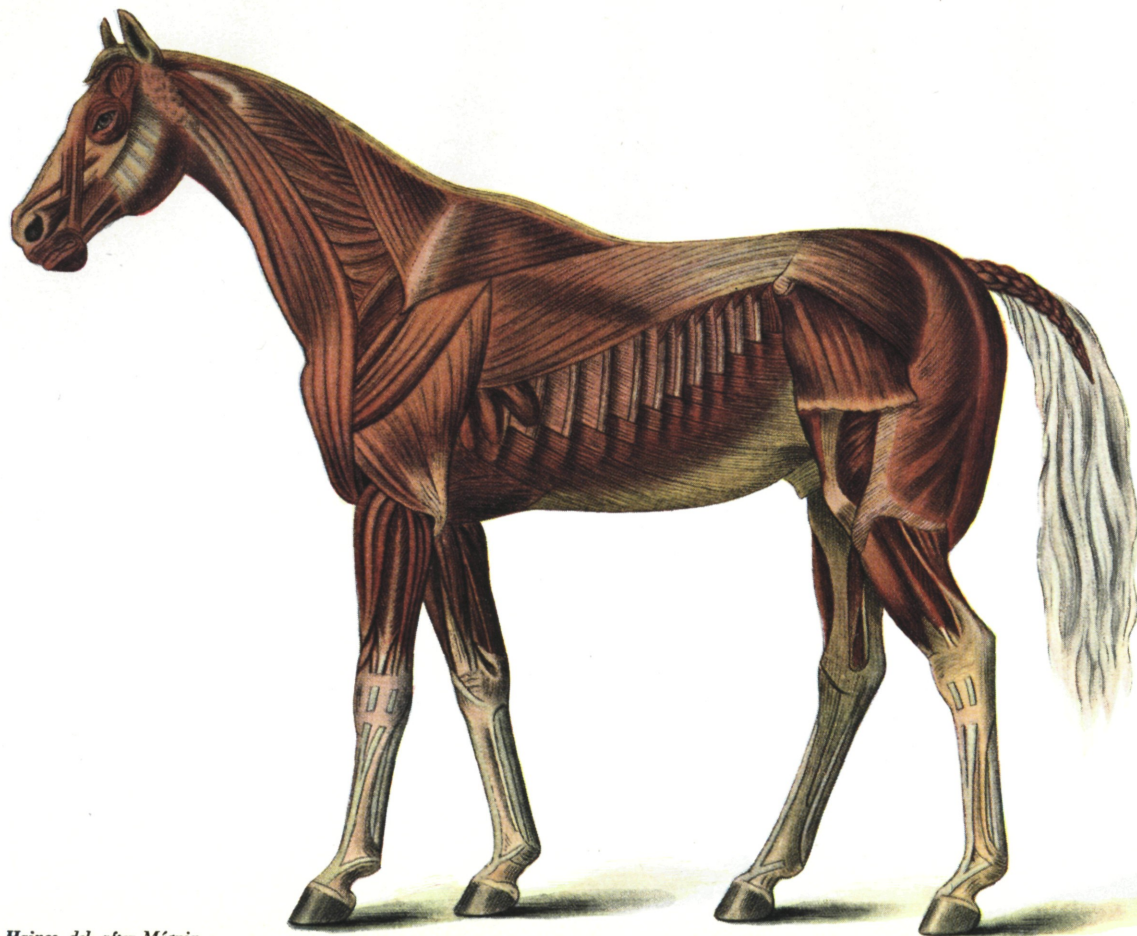
The substance of the bone is composed of a mass of combined mineral and animal matter surrounded by a fine, fibrous enveloping membrane (the periosteum) that adheres closely to the external

surface of the bone and is, in fact, the secreting membrane of the bony structure. The bony tissue proper is of two consistencies, the external portion being hard and compact, and the internal portion being spongy in character. The bones that possess this latter consistence contain also, in their spongy portion, the medullary substance known as marrow, which is deposited in large quantities in the interior of the long bones, and especially where a central cavity exists, called, for that reason, the medullary cavity. The nourishment of the bones is effected by means of the nutrient foramen, an opening established for the passage of the blood vessels that convey the nourishment necessary to the interior of the organ.

The active organs of locomotion, the muscles (pl. XXIV), speaking generally, form the fleshy covering of the external part of the skeleton and surround the bones of the extremities. They vary greatly in shape and size, being flat, triangular, long, short, or broad, and are variously named, some from their shape, some from their situation, others from their use; thus there are abductors and adductors—the pyramidal, orbicular, the digastricus, the vastus, and so on. Those that are under the control of the will, known as the voluntary muscles, appear in the form of fleshy structures, red in color, and with fibers of various degrees of fineness, and are composed of fasciculi, or bundles of fibers, united by connective or fibrous tissue, each fasciculus being composed of smaller ones but united in a similar manner to compose the larger formations, each of which is enveloped by a structure of similar nature known as the sarcolemma. Many of the muscles are united to the bones by the direct contact of their fleshy fibers, but in other instances the body of the muscle is more or less gradually transformed into a cordy or membranous structure known as the tendon or sinew, and the attachment is made by the very short fibrous threads through the medium of a long tendinous band, which, passing from a single one to several others of the bones, effects its object at a point far distant from its original attachment. In thus carrying its action from one bone to another, or from one region of a leg to another, these tendons must have smooth surfaces over which to glide, either upon the bones themselves or formed at their articulations, and this need is supplied by the secretion of the synovial fluid, a yellowish, unctuous substance, furnished by a peculiar tendinous synovial sac designed for the purpose.

Illustrations of the agency of the synovial fluid in assisting the sliding movements of the tendons are found at the shoulder joint, at the upper part of the bone of the arm, at the posterior part of the knee joint, and also at the fetlocks, on their posterior part.

As the tendons, whether singly or in company with others, pass over these natural pulleys they are retained in place by strong, fibrous bands or sheaths, which are by no means exempt from danger of



Haines, del. after Mégnin.

SUPERFICIAL LAYER OF MUSCLES.

injury, as will be readily inferred from a consideration of their important special use as supports and reinforcements of the tendons themselves.

The movable joints, or articulations, are formed generally by the extremities of the long bones, or they may exist on the surfaces of the short ones. The points or regions where the contact occurs are called the articular surface, which varies considerably in form, being in one case comparatively flat and in another elevated; or forming a protruding head or knob, with a distinct convexity; and again presenting a corresponding depression or cavity, accurately adapted to complete, by their coaptation, the ball-and-socket joint. The articulation of the arm and shoulder is an example of the first kind, and that of the hip with the thigh bone is a perfect exhibition of the latter.

The structure whose office is to retain the articulating surfaces in place is the ligament. This is usually a white, fibrous, inelastic tissue; sometimes, however, it is elastic and yellowish. In some instances it is funicular shaped or corded, serving to bind more firmly together the bones to which its extremities are attached; in others it consists of a broad membrane, wholly or partly surrounding the broad articulations, and calculated to protect the cavity from intrusion by air. This latter form, known as capsular, is usually found in connection with joints that possess a free and extended movement. The capsular and funicular ligaments are sometimes associated, the capsular appearing as a membranous sac wholly or partly enclosing the joint; the funicular, here known as an interarticular ligament, occupying the interior, and thus securing the union of the several bones more firmly and effectively than would be possible for the capsular ligament unassisted. The easy play and smooth movement of the tendons over the joints and certain points of the bones are provided by the secretion of the synovia, a yellow oily, or rather glairy, secretion. This fluid is deposited in a containing sac, the lining (serous) membrane of which forms the secreting organ. This membrane is excessively sensitive, and although it lines the inner face of the ligaments, both capsular and fascicular, it is attached only on the edges of the bones, without extending on their length, or between the layers of cartilage that lie between the bones and their articular surfaces.

As long as there is freedom from disease, traumatism, and pathological change in the bones, muscles, tendons, joints, ligaments, synovial structure, nerves, and blood vessels, the function of locomotion will continue to be performed with perfection and efficiency. On the other hand, if any element of disease becomes implanted in one or several of the parts or any change or irregularity occurs in any portion of the apparatus, lameness results.

DEFINITION OF LAMENESS

The term "lameness" signifies any irregularity or derangement of the function of locomotion, irrespective of its cause or the degree of its manifestation, whether slight or severe. The most careful observation may be necessary for its detection, and it may need the most thoroughly trained powers of discernment to identify and locate it, as in cases in which the animal is said to be fainting, tender, or to go sore. On the contrary, the patient may be so far affected as to refuse utterly to use an injured leg, and under compulsory motion may keep it raised from the ground, and prefer to travel on three legs rather than to bear any portion of the weight on the afflicted member.

This last condition of lameness and many of the lower degrees of simple lameness are easy to detect, but the first, or mere tenderness or soreness, may be difficult to identify, and at times serious results have followed from the obscurity that has enveloped the early stages of the malady. For in the absence of the treatment that an early correct diagnosis would have indicated, an insidious ailment may become so deeply rooted that it is impossible to cure and may become transformed into a disabling chronic case, or possibly one that is incurable and fatal. Hence the impolicy of depreciating early symptoms because they are not accompanied with distinct and pronounced characteristics, and from a lack of threatening appearances inferring the absence of danger.

Usually the discovery that the animal is becoming lame is an easy matter to a careful observer. Such a person will readily note the changes of movements in the animal he has been accustomed to drive or ride, unless they are very slight. But what is not always easy is the detection, after discovering an existing irregularity, of the locality of its point of origin, and whether its seat be in the near or off leg, or in the fore or the hind part of the body. These are questions often wrongly answered, notwithstanding the fact that with a little careful scrutiny the point may be easily settled. The error, which is often committed, of deciding that a sound leg is lame is the result of a misinterpretation of the physiology of locomotion in the crippled animal. Much depends on the gait with which the animal moves while under examination. The act of walking is unfavorable for accurate observation, though, if the animal walks on three legs, the decision is easy to reach. The action of galloping will often, by the rapidity of the muscular movements and their quick succession, interfere with a careful study of their rhythm, and it is only under some peculiar circumstances that the examination can be safely conducted while the animal is moving with that gait. It is while the animal is trotting that the investigation is made with the best chances of an intelligent decision, and it is while moving with that gait, therefore, that the

points should be looked for that must form the elements of the diagnosis.

Several definitions are here necessary, in order to render that which follows more easily understood. In veterinary nomenclature each two of the legs, as referred to in pairs, is called a biped. Of the four points occupied by the feet of the animal while standing at rest, forming a rectangle, the two forelegs are known as the anterior biped; the two hind legs, the posterior; the two on one side, the lateral; and one of either the front or hind biped with the opposite leg of the hind or front biped will form the diagonal biped.

Considering that in a condition of health each separate biped and each individual leg is required to perform an equal and uniform function and to carry an even or equal portion of the weight of the body, it will be readily appreciated that the result of this distribution will be a regular, evenly balanced, and smooth displacement of the body thus supported by the four legs. Therefore, according to the rapidity of the motion in different gaits, each single leg will be required at certain successive moments to bear the weight that had rested upon its congener, or partner, while it was itself in the air, in the act of moving; or, again, two different legs of a biped may be required to bear the weight of the two legs of the opposite biped while also in the air in the act of moving.

To simplify by illustration, the weight of an animal may be placed at 1,000 pounds, of which each leg, in a normal and healthy condition, supports while at rest 250 pounds. When one of the forelegs is in action or in the air and carrying no weight, its 250 pounds share of the weight will be thrown upon its congener, or partner, to sustain. If the two legs of a biped are both in action and raised from the ground, their congeners, still resting in inaction, will carry the total weight of the other two, or 500 pounds. And as the succession of movements continues, and the change from one leg to another or from one biped to another, as may be required by the gait, proceeds, there will result a smooth, even, and equal balancing of active movements, shifting the weight from one leg or one biped to another, with symmetrical precision.

Much may be learned from the study of the action of a single leg. Normally, its movements will be without variation or failure. When at rest it will easily sustain the weight assigned to it without showing hesitancy or betraying pain, and when it is raised from the ground in order to transfer the weight to its mate it will perform the act in such manner that when it is again placed on the ground to rest it will be with a firm tread, indicative of its ability to receive again the burden to be thrown back on it. In planting it on the ground or raising it again for the forward movement while in action, and again replanting it on the earth, each movement will be the same for each

leg and for each biped, whether the act is that of walking or trotting, or even of galloping.

When a leg is disabled, its mode of action will vary greatly from that when in a healthy condition, and the sound leg will also be affected in its manner of resting on the ground, of elevating itself and moving forward, and of striking the ground again when the full action of stepping is accomplished. Inability in the lame leg to sustain weight will necessitate excessive exertion by the sound one, and lack of facility or disposition to rest the lame member on the ground will necessitate a longer continuance of that action on the sound side. Changes in the act of raising the leg, or of carrying it forward, or of both, will present entirely opposite conditions between the two. The lame member will be raised rapidly, moved carefully forward, and returned to the ground with caution and hesitancy, and the contact with the earth will be effected as lightly as possible, whereas the sound leg will rest longer on the ground, move boldly and rapidly forward, and strike the ground promptly and forcibly. All this is due to the fact that the sound member carries more than its normal share of the weight of the body, the amount depending on the degree of lameness, whether it is a slight tenderness or soreness, or whether the trouble has reached a stage that compels the patient to travel on three legs.

That all this is not mere theory but rests on a foundation of fact may be established by observing the manifestations attending a single alteration in the balancing of the body. In health the support and equilibrium of that mass of the body which is borne by the forelegs are equalized and pass by regular alternations from the right to the left side and vice versa. But if the left leg, becoming disabled, relieves itself by leaning, as it were, on the right, the latter becomes consequently, practically heavier and the mass of the body will incline or settle on that side. Lameness of the left side, therefore, means dropping or settling on the right and vice versa.

HOW TO DETECT THE SEAT OF LAMENESS

As already stated, trotting the animal is the best method of detecting the seat of lameness. In conducting such an examination the animal should be unblanketed and held by a plain halter in the hands of a man who knows how to manage the paces of the animal, and the trial should always be made over a firm hard road whenever it is available. The horse should be examined from various positions—from before, from behind, and from each side. Watching the animal as it approaches, passes by, and recedes, the observer should carefully study the dropping of the body on one extremity or the other, and this can readily be detected by attending closely to the motions of the head and of the hip. The head drops on the same side on which

the mass of the body will fall, dropping toward the right when the lameness is in the left foreleg, and the hip dropping in posterior lameness, also on the sound leg, the reversal of the conditions, of course, producing reversed effects. In other words, when the animal in trotting shows signs of irregularity of action, or lameness, and this irregularity is accompanied with dropping or nodding the head, or depressing the hip on the right side of the body, at the time the feet of the right side strike the ground, the horse is lame on the left side. If the dropping and nodding are on the near side the lameness is on the off side.

That a horse is lame in a given leg, however, may be easily determined, but when it becomes necessary to decide what structure is affected, the task usually becomes more difficult. It is true that by carefully noting the manner in which a lame leg is performing its functions, scrutinizing the motions of the whole extremity, especially of the various joints that enter into its structure, by minutely examining every part of the leg, by observing the outlines, by testing the change, if any, in temperature and the state of the sensibility—all these investigations may guide the veterinarian to a correct localization of the seat of trouble. However, he must carefully refrain from forming a hasty conclusion, and, above all, must carefully examine all parts of the foot, which is the part of the horse most liable to injury and lesion. Indeed, lameness may have an apparent location elsewhere when the foot is the true seat of the trouble.

DISEASES OF BONES

PERIOSTITIS OSTITIS, AND EXOSTOSIS

Because of the close connection between the periosteum and the bone itself, it frequently is exceedingly difficult, in the case of disease, to determine which of the two parts is affected. Yet a knowledge of the fact is often of the first importance in order to obtain a favorable result from the treatment to be instituted. It is, however, evident that in most instances the bony growths that frequently appear on the surface of the bones, to which the general term "exostosis" is applied, have had their origin in an inflammation of the periosteum, or enveloping membrane, and are known as periostitis. However this may be, there frequently result, sometimes on the body of the bone, sometimes at the extremities, and sometimes involving the articulation itself, certain bony growths, or exostoses, known otherwise by the terms "splint," "ringbone," and "spavin." For these growths, the periosteum may serve as their nutrient source and support, at least after their inflammation, if not for their incipient existence.

Cause.—Inflammation of the periosteum is frequently due to wounds and bruises caused by external agencies and may result from the

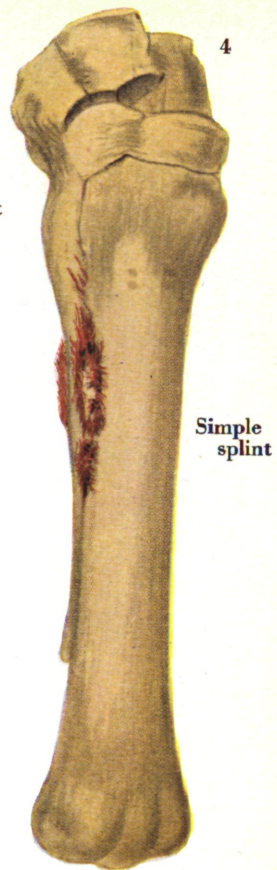
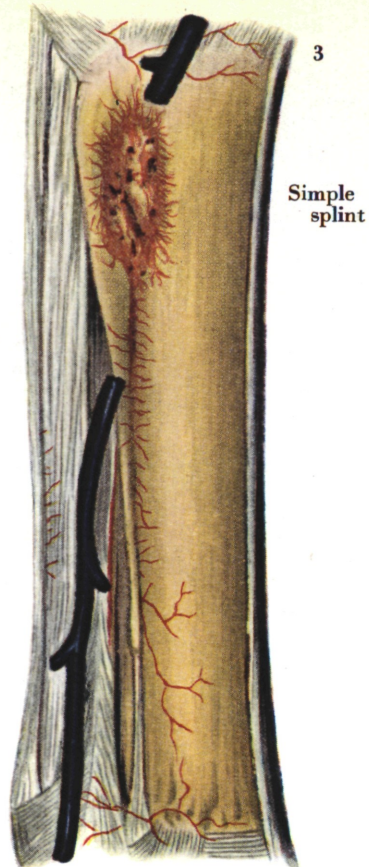
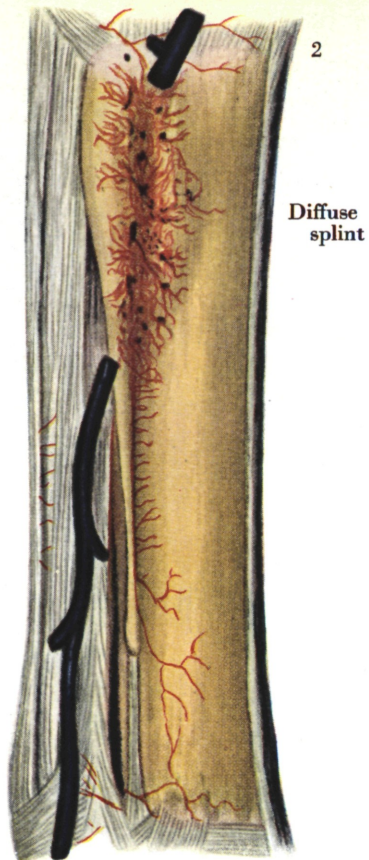
spreading inflammation of surrounding diseased tissues. The result is a deposit of a bony growth, more or less diffuse, sometimes of irregular outline and at other times projecting distinctly from the surface from which it springs, as is commonly seen in ringbone and spavin.

In recent years investigations in mineral metabolism indicate clearly that the underlying cause of certain bone diseases is a faulty calcium-phosphorus balance in the diet. It has been shown that when the ratio of calcium to phosphorus is 1:2.2 or higher, alterations in the skeletal parts are likely to occur, but when the ratio approximates 1:1, normal bony development occurs. Thus a ration consisting largely of cereals with a poor-quality hay that furnishes a rather wide calcium-phosphorus ratio may in time bring about definite symptoms of lameness, referable to pathological alterations in the bones. A deficiency of vitamin D in the diet adversely affects the mineral metabolism. Such deficiency may be expected when the diet does not include at intervals such feeds as green leafy forage, yellow corn, or carrots, and when the animal receives little direct exposure to sunlight.

Infection is also believed to play an important part in causing disease of the bones and joints. In navel ill or joint ill, the articular surfaces of some of the bones of the legs are regularly involved in the disease process, and here the infection most often occurs before birth and sometimes shortly after birth. The following germs have been incriminated: *Shigella equirulis*, staphylococci, and streptococci. The first-mentioned is frequently found in the alimentary tract of mares, and although no apparent damage may be done to the uterus of the mare, the fetus within the uterus may become infected and at birth the foal may show definite disease of the joints. The streptococci not only are present in both the digestive and the genital tracts but also cause disease of the latter and infection of the joints of the foal.

Symptoms.—Periostitis is often difficult to determine. The signs of inflammation are so obscure, the swelling of the parts is so insignificant, any increase of heat so imperceptible, and the soreness so slight, that even the most acute observer may fail to find the point of its existence, and it is often long after the discovery of the disease itself that its location is positively revealed by the visible exostosis.

Treatment.—When, by careful scrutiny, the ailment has been located, treatment must be given at once in order to prevent, if possible, any further deposit of the calcareous structure and increase of the exostotic growth. The application of water, either warm or cold, rendered astringent by the addition of alum, will be beneficial. The tendency to the formation of the bony growth, and the increase of its development after its actual formation, may often be checked by the application of a blistering agent.



Haines, del. Nos. 1, 2, and 3, from Auzoux model, No. 4, original.

SPLINT.

Should the diet be faulty as regards the mineral balance and vitamin content, appropriate changes should be made. At times turning the affected animals out on green pasture of good quality and eliminating such feed as linseed meal and bran and replacing the timothy or poor quality hay with bright, properly cured alfalfa or clover hay give very beneficial results. The addition of dicalcium phosphate and occasionally some carrots to the ration may be helpful. Recently vaccine therapy has been used with good results in certain affections of the joints in which there was some involvement of the bones. In this treatment the veterinarian collects a blood sample from the affected animal and submits the serum to a laboratory test (complement fixation) to determine the type of infection. After this determination, either a stock or autogenous vaccine is administered in increasing doses and number until the necessary improvement or recovery is obtained. The failure of any of these means and the establishment of the diseased process in the form of chronic periostitis cause various changes in the bone covered by the disordered membrane, and the result may be softening, degeneration, or necrosis, but more often it is followed by the formation of the bony growths referred to, on the cannon bone, the coronet, or the hock.

SPLINTS

Splints are bony enlargements usually on the inside of the leg, from the knee, near which they are frequently found, downward to about the lower third of the principal cannon bone (pl. XXV). Occasionally they appear on the outside of the leg. Splints are most common on the forelegs, but at times they are found on both the inside and outside of the hind legs. The size of a splint varies from that of a large nut to a very small one. They are readily perceptible both to the eye and to the touch. They may be readily detected by the hand if they have attained sufficient development in their usual situation but must be distinguished from a small, bony enlargement that may be felt at the lower third of the cannon bone, which is merely the normal buttonlike enlargement at the lower extremity of the small metacarpal or splint bone.

Usually a splint forms only a true exostosis, or a single bony growth, with a somewhat diffuse base. In some instances it assumes more important dimensions and passes from the inside to the outside of the bone, on its posterior face, between that and the suspensory ligament. This form is termed the pegged splint and constitutes a serious and permanent deformity, in consequence of its interference with the play of the fibrous cord that passes behind it, becoming thus a source of continual irritation and consequently of permanent lameness.

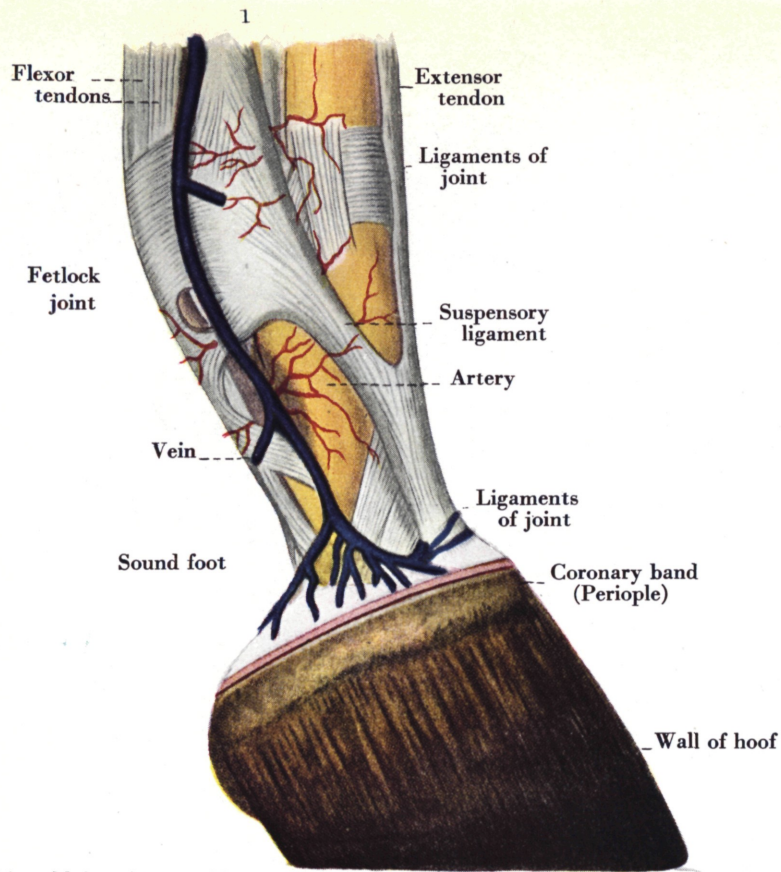
Symptoms.—When a splint causes lameness, this lameness possesses features peculiar to itself. At times it is intermittent and is more

marked when the animal is warm than when cool. If the lameness is near the knee joint, it is likely to become aggravated when the animal is put to work, and the gait acquires then a peculiar character, arising from the manner in which the leg is carried outward from the knees downward, which is done by a kind of abduction of the lower part of the leg. Other symptoms, however, than the lameness and the presence of the splint, which is its cause, may be looked for in the same connection as those that have been mentioned as pertaining to certain evidences of periostitis, in the increase of the temperature of the part, with swelling and probably pain on pressure. This last symptom is of no little importance, since its presence or absence has in many cases formed the determining point in difficult diagnosis.

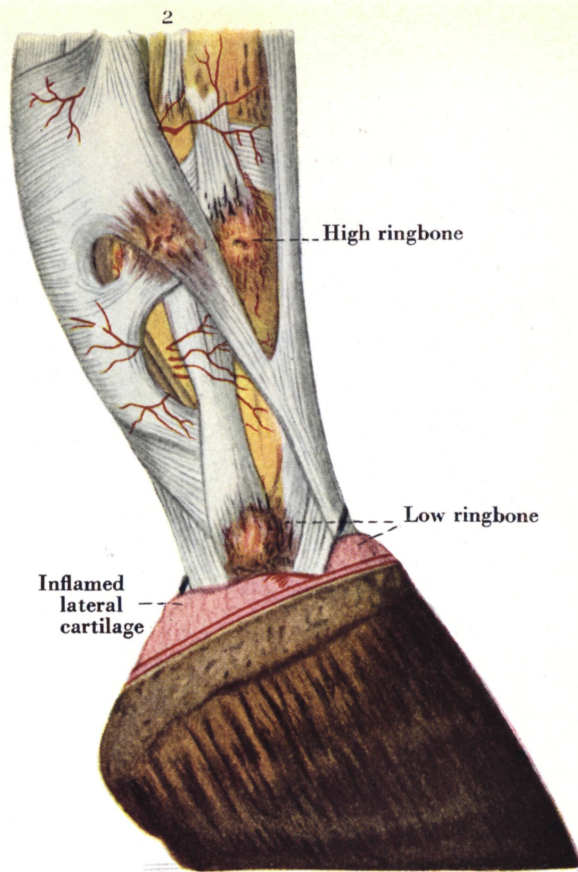
Cause.—A splint being one of the results of periostitis, and the latter one of the effects of external hurts, it naturally follows that the parts which are most exposed to blows and collisions will be those on which the splint will most commonly be found. Therefore, injuries from without are among the common causes of splints. Another cause is the overstraining from excessive labor by a young animal. The bones that enter into the formation of the cannon are three in number, one large and two smaller, which, while the animal is young, are more or less articulated, with a limited amount of mobility, but which become in maturity firmly joined by a rigid union and ossification of their interarticular surface. If the immature animal is compelled, then, to perform tasks beyond its strength, the result will be muscular straining and perhaps tearing asunder of the fibers that unite the bones at their points of juncture. Inflammation or periostitis will usually develop as the consequence of such local irritation.

Splints are of common occurrence. Though they are in some instances a cause of lameness, and their discovery and cure are sometimes beyond the ability of the most experienced veterinarians, yet as a source of vital danger to the animal, or even of functional disturbance, they are seldom serious. The worst stigma that attaches to a splint is that it injures the appearance of the animal. The inflammation at the beginning stage of the disease, acute at first, either subsides or assumes the chronic form, and the bony growth becomes permanent but does no positive harm and does not hinder the animal from working. However, an effort should be made to prevent the occurrence of a subsequent acute attack, since, as with other exostoses, the resulting acute symptoms may be followed by a new pathological activity, which will again cause a reappearance of the lameness.

Treatment.—Because of the comparative harmlessness of splints and the fact that any active and irritating treatment may so excite the parts as to bring about a renewed pathological activity, and consequently do more harm than good, it is not advisable to treat the case unless the usefulness of the animal is impaired.



SOUND FOOT.



RINGBONE.

Haines, del. from Auzoux model.

If an acute periostitis of the cannon bone has been readily discovered, the treatment already suggested for that ailment is recommended, and the astringent lotions may be relied on to bring about beneficial results. Sometimes, however, preference may be given to a lotion possessing a somewhat different quality, the alternative consisting of tincture of iodine applied to the inflamed spot several times daily. If lameness persists under this mild course of treatment a blistering agent may be used.

Other modes of treatment for splints are recommended and practiced that belong strictly to the domain of operative veterinary surgery; among these are cauterization, or the application of the fire iron and the operation of periosteotomy. These are frequently desirable in the treatment of splints that have resisted milder means.

Surgical treatment of the operative kind is usually useless, if not dangerous. The mode of the development of splints; their intimacy, greater or less, with both the large and the small cannon bones; the possibility of their extending to the back of these bones under the suspensory ligament; the dangerous complications that may follow the rough handling of the parts and a probability of their return after removal, make inadvisable removal of splints by the saw or the chisel.

RINGBONE

Ringbone is the designation of the exostosis which is found on the coronet and in the digital and phalangeal regions (pl. XXVI). The name is appropriate, because the growth extends around the coronet, which it encircles in the manner of a ring, or perhaps because it often forms on the back of that bone a regular osseous arch, through which the back tendons obtain a passage.

Cause.—As with splints, ringbones may result from severe labor in early life, before the process of ossification has been fully perfected, or they may be caused by bruises, blows, sprains, or other violence. Injuries of tendons, ligaments, or joints also may be among the causes.

Symptoms.—Periostitis of the phalanges requires careful exploration and minute inspection for its discovery and is likely to result in a ringbone of which lameness is the result.

A ringbone is more serious than a splint. Its growth, its location, its tendency to increased development, its exposure to the influence of causes of renewed danger, all tend to impart an unfavorable cast to the prognosis of a case and to emphasize the importance and the value of an early discovery of its presence and possible growth. Even when the discovery has been made, it is often too late for effectual treatment. Months may have elapsed after the first manifestation of the lameness before a discovery has been made of the lesion from which it originated. Consequently, the periostitis has been overlooked; any chance that

might have existed for preventing its advance to the chronic stage has been lost; the osseous formation is established; the ringbone is a fixed fact, and the indications are urgent and pressing.

Treatment.—Preventive treatment consists in keeping colts well nourished and in trimming the hoof and shoeing to balance the foot properly and thus prevent an abnormal strain on the ligaments. Even after the ringbone has developed, a cure may sometimes be occasioned by proper shoeing directed toward straightening the axis of the foot as viewed from the side by making the wall of the hoof from the coronet to the toe continuous with the line formed by the front of the pastern. (See Ringbone, under Diseases of the Fetlock, Ankle, and Foot, p. 411.)

SIDEBONES

On each side of the bone of the hoof—the coffin bone—there are normally two supplementary organs that are called the cartilages of the foot. They are soft, and though in a degree elastic, yet somewhat resisting, and are implanted on the lateral wings of the coffin bone. Evidently their office is to assist in the elastic expansion and contraction of the posterior part of the hoof, and their healthy and normal action doubtless contributes in an important degree to the perfect performance of the functions of that part of the leg.

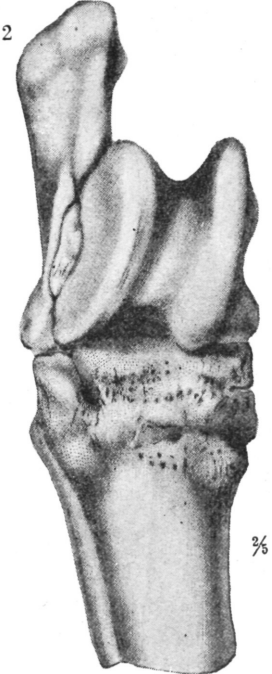
Cause.—Sidebones may be the result of a low inflammatory condition or of an acute attack as well, or may be caused by sprains, bruises, or blows; or they may arise from certain diseases affecting the foot proper, such as corns, quarter cracks, or quittor.

Symptoms.—It would naturally be inferred that the degree of interference with the proper functions of the hoof that must result from such a pathological change would be proportional to the size of the tumor, and that as the dimensions increase the resulting lameness would be greater. This, however, is not the fact. A small tumor while in a condition of acute inflammation during the formative stage may cripple a patient more severely than a much larger one in a later stage of the disease. In any case lameness is never lacking, and with its intermittent character may usually be detected when the animal has cooled off after labor or exercise. The class of animals in which this feature of the diseases is most frequently seen is that of the heavy draft horse and others similarly employed. There is a wide margin of difference in respect to the degrees of severity that may characterize different cases of sidebone. While one may be so slight as to cause no inconvenience, another may develop elements of danger that may necessitate severe surgical interference.

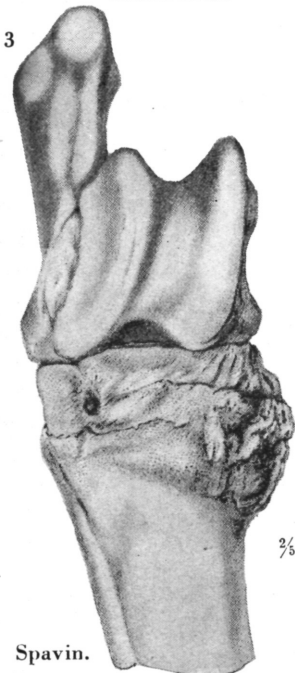
Treatment.—The curative treatment should be similar to the prophylactic, and such means should be used as will tend to prevent the deposit of bony matter by checking the acute inflammation that causes it. If this treatment is ineffectual, a competent veterinarian



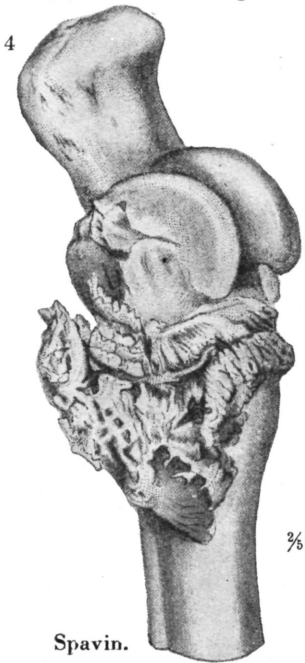
Sound hock.



Cured spavin.



Spavin.

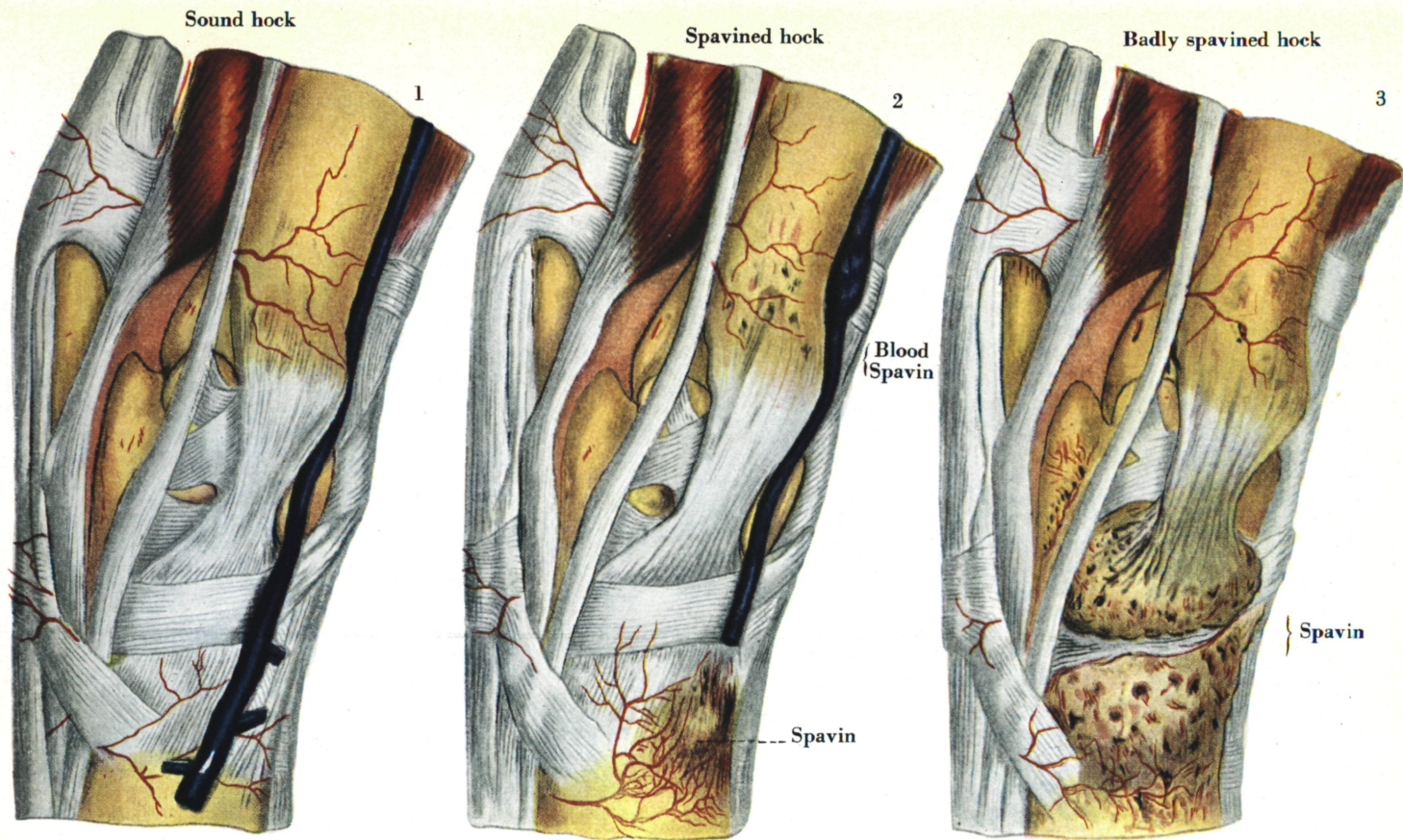


Spavin.

Haines, del.

Nos. 1, 2, and 3, original. No. 4, after Percival.

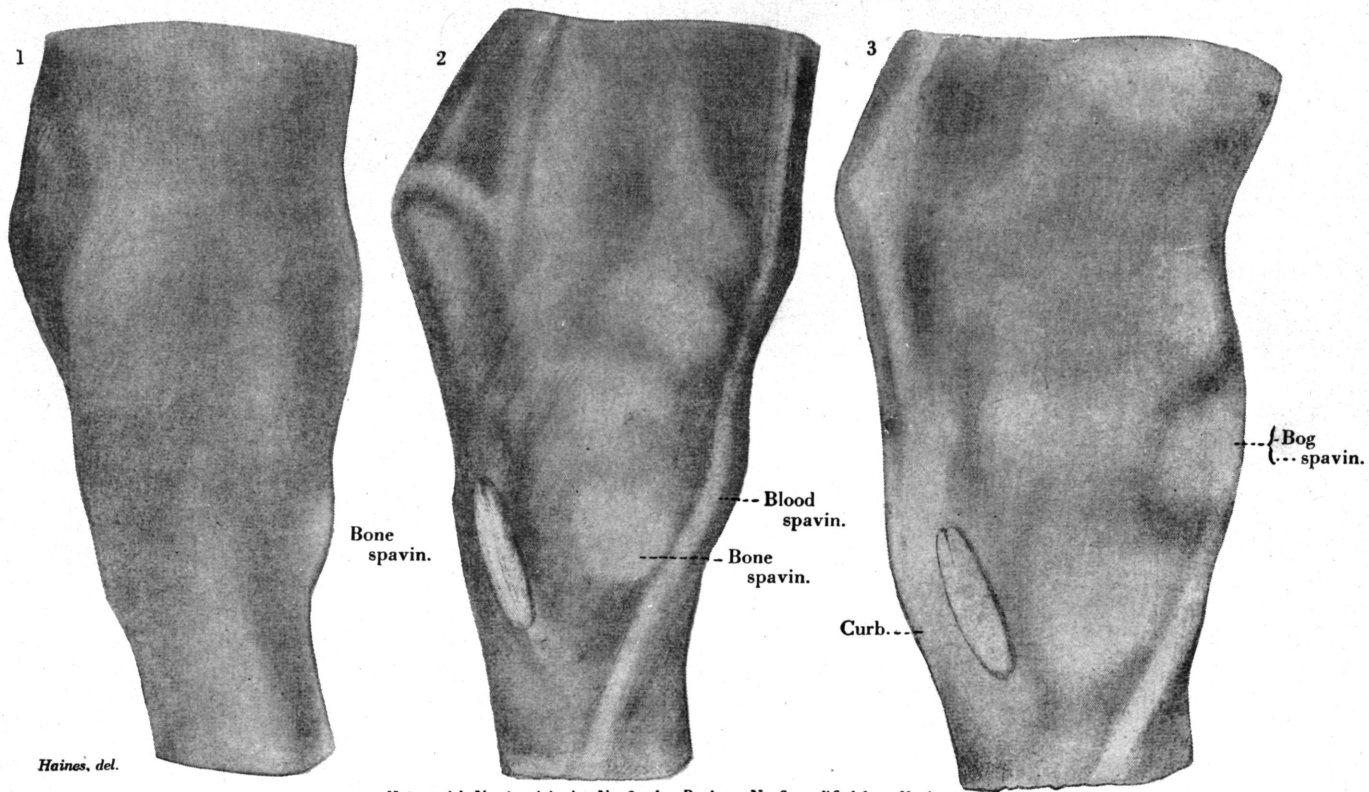
BONE SPAVIN.



Haines, del. from Auzoux model.

Haines, del.

BONE SPAVIN. HOCKS, WITH SKIN REMOVED.



Haines, del. No. 1. original. No. 2. after Berdez. No. 3. modified from Haubner.

VARIOUS TYPES OF SPAVIN.

should be called to perform the operation of neurectomy or to make a free and deep application of the firing iron. (See Sidebones under Diseases of the Fetlock, Ankle, and Foot, p. 410.)

SPAVIN

(Pls. XXVII-XXIX)

This affection, popularly termed bone spavin, is an exostosis of the hock joint. The general impression is that in a spavined hock the bony growth should be seated on the anterior and internal part of the joint, and this is partly correct, as such a growth will constitute a spavin in the most nearly correct sense of the term. But an enlargement may appear on the upper part of the hock also, or possibly a little below the inner side of the lower extremity of the shank bone, forming what is known as a high spavin; or, again, the growth may form just on the outside of the hock and become an outside or external spavin. And, finally, the entire undersurface may become the seat of the osseous deposit and involve the articular face of all the bones of the hock, which again is a bone spavin. There would seem, then, to be little difficulty in comprehending the nature of a bone spavin, and there would be none but for the fact that there are similar affections which may confuse one if the diagnosis is not carefully made.

But the hock may be "spavined," while to all outward observation it still retains its perfect form. With no enlargement perceptible to sight or touch the animal may yet be disabled by an occult spavin, an ankylosis in fact, which has resulted from a union of several of the bones of the joint.

No disease, except those acute inflammatory attacks on vital organs to which the patient succumbs at once, is more destructive to the usefulness and value of a horse than a confirmed spavin. Serious in its inception and progress, it is an ailment that, when once established, becomes a fixed condition that there is no known means of dislodging.

Cause.—The periostitis, of which it is nearly always a termination, is usually the effect of a traumatic cause operating upon the complicated structure of the hock, such as a sprain that has torn a ligamentous insertion and lacerated some of its fibers or a violent effort in jumping, galloping, or trotting; the extra exertion of starting an inordinately heavy load; an effort to recover balance from a misstep; slipping on an icy surface; sliding with worn shoes on a bad pavement; and similar causes. In this disease also, heredity plays a part. In some equine families this condition has been transmitted from generation to generation, and animals of otherwise excellent conformation have been rendered valueless by a congenital spavin.

Symptoms.—This disease is of a serious character for other reasons, among which are slowness of its development and the insidiousness of its growth. Certain indefinite phenomena and alarming changes

and incidents furnish usually the only portents of approaching trouble. Among these signs are a peculiar posture while at rest, becoming at length so habitual that it cannot fail to suggest the action of some hidden disorder. The posture is due to the action of the adductor muscles, the lower part of the leg being carried inward, and the heel of the shoe resting on the toe of the opposite foot. Then an unwillingness may be noticed in the animal to move from one side of the stall to the other. When driven, the animal travels stiffly with a sort of sidelong gait between the shafts, and after finishing the task and resting again in the stall stands with the toe pointing forward, the heel raised, and the hock flexed. Considerable heat and inflammation soon appear. The slight lameness that appears when the animal backs out of the stall ceases to be noticeable after a short distance of travel.

A minute examination of the hock may then reveal a bony enlargement that may be detected just at the junction of the hock and the cannon bone, on the inside and a little in front, and evident both to sight and touch. This enlargement, or bone spavin, grows rapidly and persistently and soon acquires dimensions that render it impossible to doubt any longer its existence or its nature. Once established, its development continues and progresses in a manner similar to that of other like affections. The argument advanced by some persons that because these bony deposits are frequently found on both hocks they are not spavins is fallacious. If they are discovered on both hocks, it proves merely that they are not confined to a single joint.

The characteristic lameness of bone spavin, as it affects the motion of the hock joint, presents two aspects. In one, it is most pronounced after the horse has been standing in the stable; in the other, when it is at work. The first is characterized by the fact that when the animal travels the toe first touches the ground, and the heel descends more slowly, the motion of flexion at the hock taking place stiffly and accompanied with a dropping of the hip on the opposite side. In the other case the peculiarity is that the lameness increases as the horse travels; that when the animal stops it favors the lame leg, and when it resumes work soon after it steps much on the toe, as in the first variety.

As with sidebones, though for a somewhat different reason, the dimensions of the spavin and the degree of lameness do not seem to bear any determinate relation, the most pronounced symptoms at times accompanying a very small growth. The distinction between the two varieties referred to in the preceding paragraph, however, may easily be determined by the fact that in most cases the first, which occurs when the animal is idle or cool, is due to a simple exostosis, whereas the second is generally connected with disease of the articulation, such as ulceration of the articular surface—a condition discussed under the subject of stringhalt.

An excellent test for spavin lameness, which may be readily applied, consists in lifting the affected leg from the ground for 1 or 2 minutes and holding the foot high to flex all the joints. An assistant with the halter strap in his hand, quickly starts the animal off at a trot, when, if the hock joint is affected, the lameness will be so greatly intensified as to lead readily to a diagnosis.

Prognosis.—For a favorable prognosis, early discovery of the disease is exceedingly important. However, the advantage of this early knowledge seldom can be obtained, and when the true nature of the trouble has become apparent it is usually too late to resort to the remedial measures that the competent veterinarian would have employed.

Rest is the most important point in the treatment of the animal. In all stages and conditions of the disease, whether the spavin is only a simple exostosis, or whether accompanied with the complication of arthritis, there must be a total suspension of effort until the danger is over. Less than a month's quiet ought not to be thought of—the longer the better.

Good results may be expected also from local applications. The various lotions that cool the parts, the astringents that lower the tension of the blood vessels, the tepid fomentations that accelerate the circulation in the engorged capillaries, the liniments of various composition, the stimulants, and applications of iodine—all these are recommended by various authorities. Counter-irritants, by the promptness of their action tend to prevent the formation of the bony deposits. The lameness will often yield to the action of blistering agents and to the alterative preparations of iodine or mercury. If the owner of a "spavined" horse really succeeds in removing the lameness, he has accomplished all that he is justified in hoping for; a further cure is impossible.

For this reason, moreover, he will do well to be on his guard against patented "cures." It is possible that nostrums may in some exceptional instances prove serviceable, but the greater number of them produce only injurious effects. The removal of the bony tumor cannot be accomplished by any such means, and if a trial of these unknown compounds should be followed by complications no worse than the establishment of one or more ugly, hairless cicatrices, it will be well for both the horse and his owner.

Rest and counterirritation, with the proper medicaments, constitute, then, the prominent points in the treatment designed for the relief of bone spavin. Yet there are cases in which all the agencies and methods referred to fail to produce satisfactory results. Either the rest has been prematurely interrupted or the blisters have failed to modify the serous infiltration, or the case in hand has some undiscernible characteristics that seem to have rendered the disease neutral to

the agencies used against it. An indication of more energetic means is then presented, and free cauterization with the firing iron becomes necessary.

At this point a word of explanation in reference to this operation of firing may be appropriate for the satisfaction of any reader who may entertain an exaggerated idea of its severity and possible cruelty. Firing is not the mere application of a hot iron to a certain part of the body. It is the methodical and scientific introduction of heat into the structure with a view to a given effect on a diseased organ or tissue and is performed only by an expert veterinary surgeon.

Either firing alone or stimulation with blistering agents is of great efficacy for the relief of lameness from bone spavin. Failure to produce relief after a few applications and after allowing a sufficient interval of rest should be followed by a second or, if needed, a third firing.

In case of further failure there is a reserve of certain special operations that have been tried and recommended, among which are cunean tenotomy, periosteotomy, and the division of nervous branches. The operations should be performed only by a qualified veterinary practitioner.

OSTEOPOROSIS (BIGHEAD)

Osteoporosis is a general disease of the bones that develops slowly and progressively and is characterized by the absorption of the calcareous or compact bony substance and the formation of enlarged, softened, and porous bone. Although it is particularly manifest in the bones of the head, causing enlargement and bulging of the face and jaws, thereby giving rise to the terms "bighead" and "swelled head," the leg bone and spine may also be affected, thus causing lameness. The disease affects horses, mules, and asses of all ages, classes, and breeds, and of both sexes. Ordinarily mules and asses are considered to be less susceptible to the disease than horses. It may occur in sporadic form, but in certain regions, such as South Africa, Australia, Madagascar, India, Hawaii, the Philippine Islands, and in the United States it sometimes appears as an enzootic, several cases usually appearing in the same stable or on the same farm, and numerous animals being affected in the same district. In the United States the disease has been found in all the States bordering the Delaware River and Chesapeake Bay, in some of the New England States, in many of the Southern States especially in low regions along the coast, and in parts of the West. In Europe the disease appears to be rare and is usually described as a form of osteomalacia, a disease that is not uncommon among cattle of that continent.

Cause.—The cause of this disease still remains somewhat obscure, although various theories have been advanced, some apparently erroneous, others more or less plausible.

The fact that the disease appears to result essentially from the loss of lime salts from the structure of the bone has led to its classification by most authorities with other mineral-deficiency diseases or disturbances of calcium and phosphorus metabolism. Other such diseases are rickets, which occurs chiefly in developing animals, and osteomalacia, which appears most commonly in adult animals, particularly cattle and swine, and rarely in horses. Whereas rickets develops in young, growing animals as a result of insufficiency or improper balance between calcium and phosphorus, often without adequate sunlight and vitamin D, the latter being obtained chiefly from such feeds as milk and green forage, osteomalacia and osteoporosis appear usually in animals in which the bone is already formed. Whether there is a heritable tendency toward these diseases is a much-discussed question. It is conceivable that bone weakness of a sort that might render the offspring unusually susceptible to dietary deficiencies, finally terminating in osteoporosis, might be transmitted by certain animals, but many times such an explanation for bighead appears not to conform with the conditions under which the disease occurs. Although the grown animal's bone is formed, additional lime salts and phosphates are required for the maintenance of the structure already established and for the nourishment of body tissues. If these minerals are not available in the feed and water that the animal consumes, they become increasingly scarce in the body and finally bones of low mineral content result through the withdrawal by the body of lime and phosphates. For example, in the Philippines, a comparative shortage of calcium salts in the feed and water of some areas seems to be responsible for the disease. Sections of other countries where osteoporosis occurs, produce forage having apparently adequate calcium content but having also an unusually high phosphorus content. The essential effect in this case seems to be similar to the effect of an actual shortage of calcium, because of the wide ratio between the two minerals. Horses that are fed large quantities of millers' byproducts, such as bran, may develop the disease, then sometimes referred to as bran disease. The excessive feeding of barley with hay having a low calcium content has the same effect. Again, the disease has been seen in horses fed rations rich in calcium and low in phosphorus, there again being a modification of the ratio between the two elements. These several observations indicate that osteoporosis, like rickets, may develop under various conditions, but the fact remains that usually an insufficiency of mineral elements or an improper balance between them underlies most cases of osteoporosis.

Several investigators are inclined to believe that vitamins probably play no part in this disease, but the knowledge of the importance of vitamin D in such a bone disease as rickets necessitates further investigation of their possible relationship to osteoporosis.

The intricacies of normal mineral metabolism are added to by the activity of such glands as the thyroid and parathyroid, which are known to have a part in the process. No concrete evidence that diseases or disturbances of these glands are directly responsible for osteoporosis in animals has been given. However, glandular disturbances should be considered in any disease having to do particularly with mineral absorption and assimilation.

The idea that the disease is contagious has been advanced by many writers, although no causative agent has been isolated. Numerous experiments have been made by inoculating the blood of an affected horse into normal horses without results. A piece of bone taken by Pearson from the diseased lower jaw of a colt was transplanted into a cavity made for it in the jaw of a normal horse but without reproducing the disease. Elliott at one time considered the disease to be of microbic origin, the result of climatic conditions, and divided the island of Hawaii into two districts, in one of which the rainfall is 150 inches, annually, where osteoporosis is very prevalent, and the second of which is dry and rarely receives rain, where the disease is unknown. Removal of animals from the wet to the dry district is followed by immediate improvement and frequently by recovery. In the wet district, horses in both good and bad stables take the disease, but in the dry districts no unfavorable or unhygienic surroundings produce the affection. As both native and imported horses are equally susceptible, there is no indication of an acquired immunity.

On some farms and in some stables osteoporosis is prevalent, a number of cases following one after another. On one farm of Thoroughbreds in Pennsylvania all the yearling colts and some of the aged horses were affected during one year, and on a similar farm in Virginia a large proportion of the horses for several years were diseased, although the cows and sheep of this farm remained unaffected.

Symptoms.—The commencement of the disease is usually unobserved by the owner, and those symptoms that develop are generally not well marked or are misleading unless other cases have been noted in the vicinity. Until the bones become enlarged the symptoms remain so vague as not to be diagnosed readily. The disease may be present under a variety of symptoms. If the bones of the hock become affected, the animal may first show a hock lameness. If the long bones are involved, symptoms of rheumatism may be the first observed, whereas if the dorsal or lumbar vertebrae are affected indications of a strain of the lumbar region are in evidence. Probably the first symptom to be noticed is a loss of vitality combined with an irregular appetite or other digestive disturbance and with a tendency to stumble while in action. These earlier symptoms, however, may pass unobserved, and the appearance of an intermittent

or migratory lameness without any visible cause may be the first sign to attract attention. This shifting and indefinite lameness, involving first one leg and then the other, is suggestive, and is even more important when it is associated with a tendency to lie down frequently in the stall and the absence of a desire to get up, or the presence of evident pain and difficulty in arising.

About this time, or probably before, swelling of the bones of the face and jaw, which is almost constantly present in this disease, will be observed. The bones of the lower jaw are the most frequently involved, and this condition is readily detected with the fingers by the bulging ridge of the bone outside and along the lower edge of the molar teeth. A thickening of the lower jawbone may likewise be identified by feeling on both sides of each branch at the same time and comparing it with the thinness of this bone in a normal horse of comparable age, size, and conformation. As a result, mastication becomes difficult or impossible and the teeth become loose and painful. The imperfect chewing that follows causes balls of feed to form that drop out of the mouth into the manger. Similar enlargements of the bones of the upper jaw may be seen, causing a widening of the face and a bulging of the bones about midway between the eyes and the nostrils. In some cases the nasal bones also become swollen and deformed, which, together with the bulging of the bones under the eyes, gives a good illustration of the reason for the application of the term "bighead."

Other bones of the body undergo similar changes, but these alterations are not so readily noted except by the symptoms they occasion. The alterations of the bones of the spinal column and the legs, while difficult to observe, are nevertheless indicated by the reluctance of the animal to get up and the desire to remain lying for long periods. The animal easily tires, moves less rapidly, and if urged to go faster may sustain a fracture or have a ligament torn from its bony attachments, especially in the lower bones of the leg. An affected horse weighing 1,000 pounds was known to fracture the large pastern bone from rearing during halter exercise.

The animal affected with osteoporosis usually becomes poor in flesh, the coat is rough and lusterless, and the skin tight and harsh, producing a condition termed "hidebound," with considerable "tucking up" of the abdomen. The horse has a short, stilted, choppy gait, which later becomes stiffer and more restricted, and on standing a position resembling that in founder is assumed, with a noticeable drop to the croup. The animal at this stage usually lies down and remains in this position for several days at a time. Bed sores frequently arise and fractures are not uncommon in consequence of attempts to arise, which complications, in addition to emaciation, result in death.

The disease may exist in this manner for 2 or 3 months to 2 years. The termination of the disease is uncertain at best but is likely to be favorable if treatment and a proper change of feed are adopted in the early stages of the malady.

Lesions.—As has been stated, the bones are principally involved. The nutrition of the bone is disturbed, as is indicated by the diminished density or rarefaction of the bony substances, the increase in the size or widening of the Haversian canal and the medullary cavity, the enlargement of the network of spaces in the spongy tissue, and the absorptive changes following the course of the Haversian system. In this process of absorption there are formed within the substance of the bone areas of erosion, indentations, or hollow spaces of irregular shape. These spaces increase in size and become confluent, causing an appearance resembling some varieties of coral. The affected bone may be readily incised with a knife, the cut surface appearing finely porous. This porous area is soft, pliable, and yields easily to the pressure of the finger. It has been shown by chemical analysis that the bone of an osteoporotic horse, when compared with that of a normal horse, shows a reduction in the amount of fat, phosphoric acid, lime, and soda, but a slight increase in organic matter and silicic acid. The bones lose their yellowish-white appearance, becoming gray and more or less brittle. The affected bones may be those of any region or portion of the body. Besides the change already noted in the bones of the face, the ends of the long bones, such as the ribs, are involved, and may be sectioned, though not so readily as the facial bones. The bones of the vertebrae are also frequently involved, necessitating great care in casting a horse, as instances are known of broken backs resulting from casting such animals for other operations. The marrow and cancellated tissue of the long bones may contain hemorrhages and soft gelatinous material or coagulated fibrin. The internal organs are usually normal, but a catarrhal condition of the gastrointestinal tract may be noted as the result of the animal's weakened condition or improper mastication resulting from the enlargement of the jaws and soreness of the teeth.

Treatment.—In each instance, it is desirable to determine, if possible, what deficiency, if any, exists in the feed. Until this is known it is impossible to treat all affected animals intelligently. The affected animal should be immediately placed under new conditions, both as to feed and surroundings. If the horse has been stable fed, it may be advisable to turn it out on grass for 2 or 3 months, preferably in another locality. If the disease has been contracted while the animal is on pasture, place the animal in the stable or corral. In the early stages of the disease beneficial results have followed the supplemental use of lime in the drinking water. One peck of lime slaked in a cask of water and additional water added from time to time is satisfactory

for this purpose and can be provided at slight expense. This treatment, at other times, may be supplemented by giving a tablespoonful of steamed bonemeal in each feeding, with free access to a large piece of rock salt, or the bonemeal may be given with a few tablespoonfuls of molasses mixed with the feed. Feeds containing mineral salts, such as beans, cowpeas, oats, and cottonseed meal, may be beneficial in certain instances in replenishing the bony substance that has been absorbed. Cottonseed meal is one of the best feeds for this purpose under certain conditions, but it should be fed carefully. Clean, bright, green, and leafy alfalfa hay is one of the best hays to feed osteoporotic animals. The animal should not be allowed to work during the active stage of the disease, nor should it be used for breeding purposes. Thorough study of the soil, as well as the feed, in sections where the disease is prevalent may reveal deficiencies that may be responsible for the condition, and proper dressing of the soil may suffice to prevent the disease. In some cases, it has been reported that castration of affected stallions or mares proved to be an effective remedy. In any event, a veterinarian should be consulted, whether one or many cases of the disease appear, so that suitable treatment may be recommended. In addition, the causative dietary deficiencies, if present, should be determined, thus preventing other cases.

FRACTURES

Fractures rank among the most serious of the lesions to which the horse—or any animal—is subject. It is of special interest to veterinarians and horse owners in view of the fact that it occurs in such a variety of forms and in a loss of the use of the animal for a considerable time. Though of less serious consequence in the horse than in man, it is always a matter of grave import. It is always slow and tedious in healing and is frequently of doubtful and unsatisfactory result.

A fracture may take place in two principal ways. In most instances it includes the total thickness of the bone and is a complete fracture. In other cases it involves only a portion of the thickness of the bone and for that reason is described as incomplete. If the bone is divided into two separate portions and the soft parts have received no injury, the fracture is a simple one; it is compound if the soft parts have suffered laceration, and comminuted if the bones have been crushed or ground into fragments. The direction of the break also determines its further classification. Broken at a right angle, it is transverse; at a different angle it becomes oblique, and it may be longitudinal or lengthwise. In a complete fracture, especially of the oblique kind, there is a condition of great importance in respect to its effect on the ultimate result of the treatment in that, from various causes, such as muscular contractions or excessive motion, the bony fragments do not maintain their mutual coaptation, but become separated at

the ends, which makes it necessary to add another descriptive term "with displacement." These words suggest the negative and introduce the term "without displacement," when the facts justify that description. Furthermore, a fracture may be intra-articular or extra-articular, as it extends into a joint or otherwise, and, intraperiosteal when the periosteum remains intact. In fact, there is no limit to the use of descriptive terminology in the case.

The condition of displacement is largely influential in determining the method of treatment and the final result of a case of fracture. This, however, depends on its location or whether its seat is in one or more of the axes of the bone, in its length, its breadth, its thickness, or its circumference. An incomplete fracture may also be either simple or comminuted. In the latter case the fragments are held together by the periosteum when it is intact; in that case the fracture belongs to the intraperiosteal class. At times, also, there is only a simple fissure or split in the bone, making diagnosis very difficult.

Causes.—There are two varieties of causes in cases of fracture. They are the predisposing and the occasional. As to the first, different species of animals differ in the degree of their liability. That of the dog is greater than that of the horse, and in horses age, mode of labor, season of the year, portion of the body most exposed, and the existence of ailments, local and general, are all to be taken into account.

Among horses, those employed in heavy draft work or driven over bad roads are more exposed than light-draft or saddle horses, and animals of different ages are not equally liable. Colts and old horses are more liable to fracture than animals in their prime.

The season of the year is undoubtedly, though only in an incidental way, an important factor in the cause of these accidents, for though they may be observed at all times, it is during the months when the slippery condition of the icy roads renders it difficult for the animals to stay on their feet that they occur most frequently. The long bones, especially those of the extremities, are most frequently the seat of fractures, because of their superficial position, their exposure to contact and collision, and the violent muscular efforts involved both in their constant, rapid movement and their labor in the shafts or at the pole of heavy and heavily laden vehicles.

Exciting or occasional causes of fracture are in most instances external traumatisms, as violent contacts, collisions, falls, or sudden muscular contractions. These external accidents are various in their character and are usually associated with quick muscular exertion. A violent, ineffectual effort to move too heavy a load; a semispasmodic bracing of the frame to avoid a fall or resist a pressure; a quick jump to escape a blow; stopping too suddenly after speeding; struggling to liberate a foot from a rail, perhaps to be thrown in the effort—these

are common examples of accidents causing fracture. Fracture of the bones of the vertebrae may occur when the animal is being cast for the purpose of undergoing a surgical operation.

Symptoms.—If the broken bone belongs to one of the extremities, the impossibility of the performance of its natural function in sustaining the weight of the body and contributing to the act of locomotion is usually complete, though the degree of disability will vary according to the kind of fracture and the bone that is injured. For example, in a fracture of the cannon bone without displacement, or of one of the phalanges, which are surrounded and sustained by a complex fibrous structure, there may be some amount of resting on the foot. On the contrary, if the shank bone or the bone of the forearm is fractured, it would be very difficult for the leg to support the body to any degree, and in a fracture of the lower jaw, it would obviously be impossible for the animal to masticate the feed.

It seldom happens that a fracture is not accompanied with greater or less deformity of the region or the leg affected. This is due to the exudation of the blood into the meshes of the surrounding tissues and to the displacement between the fragments of the bones, with subsequent swelling that follows the inflammation of the surrounding tissues. The character of the deformity will mainly depend on the manner in which the displacement occurs.

Normally the legs move with the joints as their only centers or bases of action, with no participation of intermediate points, whereas in a case of fracture the flexibility and motion that will be observed at unnatural points are among the characteristic signs of the lesion. No one need be told that when the shaft of a leg is seen to bend midway between the joints, with the lower portion swinging freely, the leg is broken. There are still some conditions, however, in which the excessive mobility is not easy to detect. Such are the cases in which the fracture exists in a short bone, near a movable joint, or in a bone in a region where several short and small bones are united in a group, or even in a long bone the situation of which is such that the muscular covering prevents the visible manifestation of the symptom.

If the situation of a fracture precludes its discovery by means of this abnormal flexibility, other modes of detection remain. There is one method that is absolute and positive and that can be applied in by far the most, though not in all, cases. This is crepitation, or the peculiar effect produced by the friction of the fractured surfaces one against another. Though it can be heard, it can scarcely be called a sound, for the grating of the parts as the rubbing takes place is more felt than heard; however, there is no mistaking its import in cases favorable for the application of the test. The conditions in which it is not available are those of incomplete fracture, in which the mobility of the part is lacking, and those in which the whole array of phenomena

are usually obscure. To obtain the benefit of this sign requires deliberate, careful, and gentle manipulation. Sometimes the slightest movement will be sufficient for its development, after much rougher handling has failed to discover it. Perhaps the failure in the latter case is due to a sort of defensive spasmodic rigidity caused by the pain resulting from the rude interference.

More or less reactive fever is a usual accompaniment of a fracture. Ecchymosis in the parts is a natural occurrence and is more easily discovered in animals possessing a light-colored and delicate skin than in those of any other character.

There are difficulties in the diagnosis of an incomplete fracture, even sometimes when there is a degree of impairment in the function of locomotion, with evidences of pain and swelling at the seat of lesion. There should then be a careful examination for evidences of a blow or other violence sufficient to account for the fracture, though often a suspicion of its existence can be converted into a certainty only by a minute history of the patient if it can be obtained up to the moment of the occurrence of the injury. A diagnosis should not be hastily pronounced, as serious and fatal complications have been known to follow careless conclusions in cases of this nature.

Fractures are liable to complications, especially those of a traumatic character, such as extensive lacerations, tearing of tissues, punctures, and contusions. Unless these are in communication with the fracture itself, it is best to treat them simply as independent lesions on other parts of the body. A traumatic emphysema at times causes trouble, and abscesses, more or less deep and diffused, may follow. In some cases small, bony fragments from a comminuted fracture, becoming loose and acting as foreign bodies, give rise to troublesome fistulous tracts. A frequent complication is hemorrhage, which often becomes of serious consequence. A fracture in close proximity to a joint may be accompanied with dangerous inflammations of important organs and induce an attack of pneumonia, pleurisy, arthritis, etc., especially, if near the chest; it may also cause luxations, or dislocations. Gangrene, as a consequence of contusions, hemorrhage, or an impediment to the circulation, caused by unskillfully applied apparatus, occasionally occurs; lockjaw also is not an uncommon occurrence. Even founder, or laminitis, has been met with as the result of forced and long-continued immobility of the feet in the standing posture, as one of the involvements of unavoidably protracted treatment.

When a simple fracture has been properly treated and the broken ends of the bone have been securely held in coaptation, one of two things will occur. Either—and this is the more common event—there will be a union of the two ends by a solid cicatrix, the callus, or the ends will continue separated or become only partially united by an intermediate fibrous structure. In the first instance the fracture is con-

solidated or united; in the second there is a false articulation, or pseudarthrosis.

The time required for a firm union or true consolidation of a fracture varies with the character of the bone affected, the age and constitution of the patient, and the general conditions of the case. The union will be perfected earlier in a young than in an adult animal, and sooner in the latter than in the aged, and a generally healthy condition is, of course, in every respect, an advantage. Considering the process in its simplest form, in a case in which it advances without interruption or complication to a favorable result, it occurs about as follows:

On the occurrence of the injury an effusion of blood takes place between the ends of the bone. The coagulation of the fluid soon follows, and this, after a few days, undergoes absorption. There is then an excess of inflammation in the surrounding structure, which soon spreads to the bony tissue, when a true osteitis is established, and the compact tissue of the bone becomes the seat of a new vascular organization and of a certain exudation of plastic lymph, appearing between the periosteum and the external surface of the bone, as well as on the inner side of the medullary cavity. After a few days the ends of the bone thus surrounded by this exudate become involved in it, and the lymph, becoming vascular, is soon transformed into cartilaginous, and in due time into bony, tissue.

Thus the time required for the consolidation of the fractured segments is divisible into two distinct periods. In the first they are surrounded by an external bony ring, and the medullary cavity is closed by a bony plug or stopper, constituting the period of the provisional callus. This is followed by the period of permanent callus, during which the process of converting the cartilaginous into the osseous form is going forward.

The restorative process is completed sooner in carnivorous than in herbivorous animals. In the former the leg may be healed sufficiently to use within 4 weeks, but with the latter 6 weeks to 2 months is not too long to allow before removing the supporting apparatus from the leg.

This, in general, represents the healing process in a vigorous animal when the bones have been properly set, and especially when the bony fragments have been kept in a state of perfect immobility and there has been no friction to prevent the osseous union of the two portions. Otherwise, instead of a solid and practicable bony union the sequel of the accident is sometimes a false joint, composed of mere flexible cartilage, a poor pseudarthrosis. The explanation of this appears to be that, first, the sharp edges of the ends of the bone disappear by becoming rounded at their extremities by friction and polishing against each other. Then follows an exudation of a plastic nature that becomes transformed into a cartilaginous layer of a rough,

articular aspect. In this, bony nuclei soon appear, and the lymph secreted between the segments thus transformed, instead of becoming truly ossified, is changed into a sort of fibrocartilaginous pouch, or capsular sac, in which a somewhat albuminous secretion or pseudosynovia, permits the movement to take place. Most commonly, however, the union of the bony fragments is obtained wholly through the medium of a layer of fibrous tissue, and it is because the union has been accomplished by a ligamentous formation only that motion becomes practicable.

Treatment.—In the treatment of a fracture, the nature of the lesion is of paramount importance. A simple fracture occurring in a bone where the ends can be firmly secured in coaptation presents the most favorable condition for successful treatment. If it is that of a long bone, it will be the less serious if situated at or near the middle than in close proximity to a joint, from the fact that perfect immobility can rarely, in the latter case, be obtained without incurring the risk of subsequent rigidity of the joint.

A simple fracture is always less serious than a compound one. A comminuted is always more dangerous than a simple fracture, and a transverse break is easier to treat than an oblique one. The most serious are those situated on parts of the body in which it is difficult to obtain perfect immobility, and especially those accompanied with severe contusions and lacerations in the soft parts; the protrusion of fragments through the skin; the division of blood vessels by the broken ends of the bone; the existence of an articulation near the point to which inflammation is likely to extend; the luxation of a fragment of the bone; laceration of the periosteum; the presence of a large number of bony particles, the result of the crushing of the bone—all these are circumstances that discourage a favorable prognosis and weigh against the hope of saving the animal for future usefulness.

Fractures that may be considered curable are those that are not conspicuously visible, as those of the ribs, where displacements are either very limited or do not occur, the parts being kept in place by the nature of their position, the shape of the bones; the articulations they form with the vertebrae, the sternum, or their cartilages of prolongation; those of transverse processes of the lumbar vertebrae; those of the bones of the face; those of the ilium; and that of the coffin bones. To continue the category, the following are evidently curable when their position and the character of the patient contribute to aid the treatment: Those of the cranium, in the absence of cerebral lesions; those of the jaws; of the ribs, with displacement; of the hip; and those of the bones of the leg in movable regions, but where their vertical position admits of perfect coaptation.

On the contrary, a compound, complicated, or comminuted fracture, in whatever region it may be situated, may be counted incurable.

Usually the fracture of the bones of the extremities in a horse is a serious casualty, the more so proportionately as the higher region of the leg is affected. In working animals it is exceedingly difficult to treat a fracture in such a manner as to restore a leg to its original perfection of movement. A fracture of a single bone of an extremity in a breeding stallion or mare will not necessarily impair the value of the animal as a breeder.

In treating fractures time is an important element and delays are dangerous. Those of recent occurrence unite more easily and more regularly than older ones.

As a general rule, fractures have less serious consequences and are more easily treated in animals of the smaller species than in those of the larger ones. The difference in weight and size, and consequent facility, in the case of the smaller animal, in handling and making the necessary applications of dressings and other appliances for the purpose of securing the indispensable immobility of the parts, and usually a less degree of uneasiness in the deportment of the patients, are considerations in this connection.

Age and temper are important factors of cure. A young, growing, robust patient is amenable to treatment that an old animal with a waning constitution would be unable to endure, and a docile, quiet disposition will act cooperatively with remedial measures that would be neutralized by the fractious opposition of a peevish and intractable sufferer.

The fulfillment of three requirements is indispensable in all fractures. The first is the reduction, or the replacement, of the parts as nearly as possible to their normal position. The second is their retention in that position for a period sufficient for the formation of the provisional callus; and the third, which, in fact, is but an incident of the second, is the careful avoidance of any accidents that might disturb the curative process.

In reference to the first consideration, it must be remembered that the accident may happen at a distance from home, and to get the animal there becomes the first duty to be attended to. Of course, this must be done as carefully as possible. If it can be treated on the spot, so much the better, though this is seldom practicable. Therefore, the animal either must walk or be carried home. If the first, every caution must be observed in order to obviate additional pain and to avoid any aggravation of the injury. Led slowly, and with partial support, if practicable, the animal may make the journey without bad results. If it is carried, it must be by means of a wagon, a truck, or an ambulance; the last, being designed and adapted to the purpose, would, of course, be the most suitable vehicle. As a precaution that should never be overlooked, a temporary dressing should

first be applied. This may be so done as for the time to answer all the purposes of the permanent adjustment and bandaging. Without thus securing the patient, a fracture of an inferior degree may be transformed to one of the severest kind, and, indeed, a curable changed to an incurable injury. One case was reported in which a fast-trotting horse, after running away in a fright caused by the whistle of a locomotive, was found on the road limping with excessive lameness in the off foreleg and walked with comparative ease some 2 miles to a stable before being seen by a veterinarian. Its immediate removal in an ambulance was advised, but before that vehicle could be procured the horse lay down, and on being made to get on its feet was found to have well-marked comminuted fracture of the os suffraginis, with considerable displacement. The patient, however, after long treatment, made a comparatively good recovery and though with a large, bony deposit, a ringbone, was able to trot in the forties.

In an incomplete fracture, where there is no displacement, the necessity of reduction does not exist. With the bone kept in place by an intact periosteum and the fragments secured by the uninjured fibrous and ligamentous structure that surrounds them, there is no dislocation to correct. Reduction is also at times rendered impossible by the seat of the fracture itself, by its dimensions alone, or by the resistance arising from muscular contraction. That is illustrated even in small animals, as in dogs, by the exceeding difficulty encountered in bringing together the ends of a broken femur or humerus, the muscular contractions being even in these animals sufficiently forcible to renew the displacement.

Generally, therefore, only fractures of the long bones, and then at points not in close proximity to the trunk, may be considered to be amenable to reduction. Some of the more superficial bones, as those of the head, of the pelvis, and of the thoracic walls, may in some cases require special manipulations and appliances for their retention in their normal positions; hence the treatment of these and of a fractured leg cannot be the same.

The methods of accomplishing reduction vary with the features of each case, the manipulations being necessarily modified to meet different circumstances. If the displacement is in the thickness of the bone, as in transverse fracture, the manipulation of reduction consists in applying constant pressure on one of the fragments, while the other is kept steady in its place, the object of the pressure being the reestablishment of the exact coincidence of the two bony surfaces. If the displacement has taken place at an angle it will be sufficient, in order to effect the reduction, to press on the summit, or apex, of the angle until its disappearance indicates that the parts have been brought into coaptation. This method is often practiced in the treat-

ment of a fractured rib. In a longitudinal fracture, or when the fragments are pressed together by the contraction of the muscles to which they give insertion until they so overlap as to correspond by certain points of their circumference, the reduction can be accomplished by effecting the movements of extension, counter extension, and coaptation. Extension is accomplished by making traction on the lower portion of the leg. Counterextension consists in firmly holding or confining the upper or body portion in such manner that it shall not be affected by the traction applied to the lower part. In other words, the operator, grasping the leg below the fracture, draws it down or away from the trunk, while he seeks not to draw away, but simply to keep the upper portion immovable until the broken ends of bone are brought to their natural relative positions, when the coaptation, which is thus effected, has only to be made permanent by the proper dressing to perfect the reduction.

In treating a fracture in the horse, it is necessary to have not only several assistants to apply the necessary force but also in many cases mechanical aids. In a fracture with displacement of the forearm of a horse, for instance, the following procedure is the proper one: The patient must be carefully cast, on the uninjured side, with ropes or a broad, leather strap about 18 feet long passed under and around the body and under the axilla of the fractured leg and secured at a point opposite to the animal and toward its back. This will form the mechanical means of counterextension. Another rope will then be placed around the inferior part of the leg below the point of fracture, with which to produce extension, and this will sometimes be furnished with a block and pulleys, in order to augment the power when necessary; there is, in fact, always an advantage in their use, to obtain steadiness and uniformity, as well as increased power. It is secured around the fetlock or the coronet or, even better, above the knee and nearer the point of fracture, and is committed to assistants. The traction on this should be firm, uniform, and slow, without relaxing or jerking, while the operator carefully watches the process. If the bone is superficially situated he is able, by the eye, to judge of any changes that may occur in the form or length of the parts under traction, and discovering, at the moment of its happening, the restoration of symmetry in the disturbed region, he gently but firmly manipulates the place until all appearance of severed continuity has vanished. Sometimes the fact and the instant of restoration are indicated by a peculiar sound or "click" as the ends of the bones slip into contact, to await the next step of the restorative procedure.

The process is the same when the bones are covered with thick muscular masses except that it is attended with greater difficulties from the fact that the finger must be substituted for the eye and taxis must take the place of sight.

It frequently happens that perfect coaptation is prevented by the interposition, between the bony surfaces, of such substances as a small fragment of detached bone or a clot of blood; sometimes the extreme obliquity of the fracture, by permitting the bones to slip out of place, is the opposing cause. These are difficulties that cannot always be overcome, even in small-sized animals, and still it is only when they are mastered that a correct consolidation can be looked for. Without it the continuity between the fragments will be by a deformed callus, the union will leave a shortened, crooked, or angular leg, and the animal will be disabled.

If timely assistance can be obtained, and the reduction accomplished immediately after the occurrence of the accident, that is the best time for it, but if it cannot be attended to until inflammation has become established and the parts have become swollen and painful, time must be allowed for the subsidence of these symptoms before attempting the operation. A spasmodic, muscular contraction that sometimes interposes a difficulty may be easily overcome by subjecting the patient to general anesthesia, and need not, therefore, cause any loss of time. A tendency to this may also be overcome by the use of sedatives and antiphlogistic remedies.

The reduction of the fracture having been accomplished, the problem that follows is that of retention. The parts that have been restored to their natural position must be kept there, without disturbance or agitation, until the perfect formation of a callus, and it is here that ample latitude exists for the exercise of ingenuity and skill by the veterinarian in the contrivance of the necessary apparatus. One of the most important conditions available to the surgeon in treating human patients is denied to the veterinarian. This is position. The intelligence of the human patient cooperates with the instructions of the surgeon; on the other hand, there is a continual antagonism between the animal patient and the veterinarian, and the forced extension and fatiguing position that must for a considerable period be maintained as a condition of restoration require special and effective appliances to insure successful results. To obtain complete immobility is scarcely possible. For this reason, as will subsequently be seen, the use of slings and the restraint of the injured animals in very narrow stalls is much to be preferred to the practice sometimes recommended of allowing entire freedom of motion by turning them loose in box stalls. The restlessness of the patients and their unwillingness to submit quietly to the changing of the dressings make it necessary to use permanent and immovable bandages, which should be retained without disturbance until consolidation is complete.

The materials composing the retaining apparatus consist of oakum, bandages, and splints, with an agglutinating compound that forms a kind of cement by which the different constituents are blended into

a consistent mass to be spread on the surface covering the locality of the fracture. Its components are black pitch, rosin, and Venice turpentine, blended by heat. The dressing may be applied directly to the skin, or a covering of thin linen may be interposed. Dextrin mixed while warm with burnt alum and alcohol cools and solidifies into a stony consistence, and is preferable to plaster of paris, which is less friable and has less solidity, besides being heavier and requiring constant additions as it becomes older. Starch and plaster of paris form another good compound.

In applying the dressing, the leg is usually padded with a cushion of oakum thick and soft enough to equalize the irregularities of the surface and to form a bedding for the protection of the skin from chafing. Over this the splints are placed. The materials for these are, variously, pasteboard, thin wood, bark, laths, gutta-percha, strips of thin metal, as tin or perhaps sheet iron. They should be of sufficient length not only to cover the region of the fracture but to extend sufficiently above and below to render the immobility more nearly complete than in the surrounding joints. The splints are covered with cloth bandages—linen preferably—soaked in a glutinous mixture. These bandages should be carefully applied to produce a firm but light binding. They are usually made to cover the entire length of the leg in order to avoid the possibility of interference with the circulation of the extremity as well as for the prevention of chafing. They should be rolled from the lower part of the leg upward and carefully secured against loosening.

These permanent dressings always need careful watching with reference to their immediate effect on the region they cover, especially during the first days after their application. Any manifestation of pain, or any appearance of swelling above or below, or any odor suggestive of suppuration should excite suspicion, and a thorough investigation should follow without delay. The removal of the dressing should be performed with great care, and especially so if time enough has elapsed since its application to allow of a probability of a commencement of the healing process or the existence of any points of consolidation. With the original dressing properly applied in its entirety in the first instance, the entire extremity will have lost all chance of mobility, and the repairing process may be permitted to proceed without interference. There will be no necessity and there need be no haste for removal or change except under such special conditions as have just been mentioned, or when there is reason to think that solidification has become perfect, or for the comfort of the animal, or for its readaptation in consequence of the atrophy of the limb from want of use. Owners of animals are often tempted to remove a splint or bandage prematurely at the risk of producing a second fracture in consequence of the failure of the callus properly to consolidate.

The method of applying the splints that has been described refers to the simple variety only. In a compound fracture, the same rules must be observed, except that openings should be left through the thickness of the dressing, opposite the wound, in order to permit the escape of pus and to obtain access to the points requiring treatment.

FRACTURE OF CRANIAL BONES

Fractures of the cranial bones in horses are comparatively rare. When they occur it is as the result of external violence, usually happening when the animal in running away comes in collision with a wall, tree, or other obstruction, or they may occur from pulling on the halter, breaking it with a jerk and being thrown backward, as in rearing too violently. Under these conditions fractures of the parietal, frontal, and sphenoid bones sometimes take place. These fractures may be of both the complete and the incomplete kinds, which indeed is usually the case with those of the flat bones, and they are likely to be complicated with lacerations of the skin, in consequence of which they are easily seen. When the skin is intact, however, diagnosis becomes difficult.

Symptoms.—The incomplete variety may be unaccompanied with any special symptoms, but in the complete kind one of the bony plates may be so far detached as to press upon the cerebral substance with sufficient force to produce serious nervous complications. When the injury occurs at the base of the cranium, hemorrhage may be looked for, with paralytic symptoms, and when these are present the usual termination is death. However, the symptoms of an apparently very severe concussion may disappear, resulting in an early and complete recovery, and the veterinarian will therefore do well to avoid undue haste in making a prognosis. In fractures of the orbital or the zygomatic bones, the danger is less serious than with injuries otherwise located about the head.

Treatment.—The treatment of cranial fractures is simple, though involving the best skill of an experienced veterinarian. When incomplete, hardly any interference is needed; even simple bandaging may usually be dispensed with. In the complete variety the danger to be combated is compression of the brain, and attention to this indication must not be delayed. The means to be employed are the trephining of the skull over the seat of the fracture and the elevation of the depressed bone or the removal of the portion that is causing the trouble. Fragments of bone in comminuted cases, bony exfoliations, collections of fluid, or even protruding portions of the brain substance must be carefully cleansed away and a simple bandage so applied as to facilitate the application of subsequent dressings.

FRACTURES OF THE BONES OF THE FACE

In respect to their origin—usually traumatic—these injuries rank with the preceding and are commonly of the incomplete variety. They may easily be overlooked and may even sometimes escape recognition until the reparative process has been well established and the wound is discovered owing to the prominence caused by the presence of the provisional callus that marks its cure. When the fracture is complete it will be marked by local deformity, mobility of the fragments, and crepitation. Nasal hemorrhage, roaring, frequent sneezing, loosening or loss of teeth, difficulty of mastication, and inflammation of the cavities of the sinuses are varying complications of these accidents. The object of the treatment should be the restoration of the depressed bones as nearly as possible to their normal position and their retention in place by protecting splints, which should cover the entire facial region. Special precautions should be observed to prevent the patient from disturbing the dressing by rubbing its head against surrounding objects, such as the stall, manger, or rack. Clots of blood in the nasal passages must be washed out, collections of pus removed from the sinuses, and if the teeth are loosened and likely to fall out, they should be removed. If suffocation is threatened, tracheotomy should be performed.

FRACTURES OF THE PREMAXILLARY BONE

These are usually encountered in connection with fractures of the nasal bone and may take place either in the width or the length of the bone.

The deformity of the upper lip, which is drawn sidewise in this lesion, renders it easy of diagnosis. The abnormal mobility and the crepitation, with the pain manifested by the patient when undergoing examination, are concurrent symptoms. Looseness of the teeth, abundant salivation, and entire inability to grasp the feed complete the symptomatology of these accidents. In the treatment, splints of gutta-percha or leather are sometimes used, but they are difficult to apply. The union of the bones is usually best accomplished by means of metallic sutures.

FRACTURES OF THE LOWER JAW

A fracture in this region is of frequent occurrence. It involves the body of the bone, at its symphysis, or back of it, and includes one or both of its branches, either more or less forward, or at the posterior part near the temporomaxillary articulation, at the coronoid process.

Falls, blows, or other external violence, or powerful muscular contractions during the use of the speculum, are among the causes of this lesion. The fracture of the neck, or that portion formed by the junction of the two opposite sides, and of the branches in front of the

cheeks, causes the lower jaw, the true dental arch, to drop, without the ability to raise it again to the upper, and the result is a peculiar and characteristic physiognomy. The grasping and mastication of feed become impossible; there is an abundant escape of fetid and sometimes bloody saliva, especially if the gums have been wounded; there is excessive mobility of the lower end of the jawbone; and there is crepitation and frequently paralysis of the under lip. Although an animal suffering with a complete and often compound and comminuted fracture of the submaxilla presents at times a serious aspect, the prognosis of the case is comparatively favorable, and recovery is usually only a question of time. The severity of the lesion corresponds in degree to that of the violence to which it is due, also to the resulting complications and the situation of the wound. It is simple when at the symphysis, but becomes more serious when it affects one of the branches, and most aggravated when both are involved. Fracture of the coronoid process becomes important principally as an evidence of the existence of a morbid diathesis, such as osteoporosis, or the like.

The particular seat of the injury, with its special features, will determine the treatment. For a simple fracture, without displacement, provided there is no laceration of the periosteum, an ordinary supporting bandage will usually be sufficient, but when there is displacement the reduction of the fracture must first be accomplished, and for this special splints are necessary. In a fracture of the symphysis or of the branches, the adjustment of the fragments by securing them with metallic sutures is the first step necessary, to be followed by the application of supports, consisting of splints of leather or sheets of metal, the entire front of the head being then covered with bandages prepared with adhesive mixtures. During the entire course of treatment an artificial method of feeding becomes necessary. This is accomplished by forcing between the lips, by means of a syringe, milk or nutritive gruels until the consolidation is sufficiently advanced to permit the ingestion of more solid feed. The callus will usually be sufficiently hardened in 2 to 3 weeks to allow a change of diet to mashes of cut hay and scalded grain, until the removal of the dressing restores the animal to its former habit of mastication.

FRACTURES OF THE VERTEBRAE

These are not common, but when they occur the bones most frequently injured are those of the back and loins.

Causes.—The ordinary causes of fracture are responsible here as elsewhere, such as heavy blows on the spinal column, severe falls while conveying heavy loads, and especially violent efforts in resisting the process of casting. Although occurring more or less frequently under the latter circumstances, the accident is not always attributable to carelessness or error in management. It may some-

times result from such a cause as a badly prepared bed, the accidental presence of a hard body concealed in the straw, or a heavy fall when the movements of the patient have not been sufficiently controlled by an effective apparatus and its skillful adaptation, but it is quite as likely to be caused by the violent resistance and the consequent powerful muscular contraction by the frightful patient. The simple fact of the overarching of the vertebral column, with excessive pressure against it from the intestinal mass, owing to the spasmodic action of the abdominal muscles, may account for it, and so also may the struggles of the animal to escape from the restraint of the hobbles while frantic under the pain of an operation without anesthesia. In these cases the fracture usually occurs in the body or the annular part, or both, of the posterior dorsal or the anterior lumbar vertebra. When the transverse processes of the last-named bones are injured, it is probably in consequence of the heavy concussion incident to striking the ground when cast. The diagnosis of a fracture of the body of a vertebra is not always easy, especially when recent or when there is no accompanying displacement.

Symptoms.—Certain peculiar signs accompanying the occurrence of the accident while an operation is in progress should at once excite the suspicion of the veterinarian. In the midst of a violent struggle the patient becomes suddenly quiet; the movement of a sharp instrument, which at first excited resistance, fails to give rise to any further evidence of sensation; perhaps a general trembling, lasting for a few minutes, will follow, succeeded by a cold, profuse perspiration, particularly between the hind legs, and frequently there will be micturition and defecation. Careful examination of the vertebral column may then detect a slight depression or irregularity in the direction of the spine, and there may be a diminution or loss of sensation in the posterior part of the trunk, while the anterior portion continues to be as sensitive as before. When the animal attempts to get on his feet, however, after the removal of the hobbles, only the fore part of the body will respond to the effort, a degree of paraplegia being present, and while the head, neck, and fore part of the body will be raised, the hindquarters and hind legs will remain inert. The animal may perhaps succeed in rising and probably may be removed to the stall, but the displacement of the bone will follow, converting the fracture into one of the complete kind, either through the exertion of walking or by a renewed attempt to rise after another fall before reaching the stall. By this time the paralysis is complete, and the extension of the meningitis, which has become established, is soon reached.

To say that the prognosis of fracture of the body of the vertebra is always serious is to speak very mildly. It would be better, perhaps,

to say that occasionally a case may recover. Fractures of the transverse processes are less serious.

Treatment.—If there is displacement, and the existence of serious lesions may be inferred from the nervous symptoms, the animal should be killed. If, however, it is fairly evident that no displacement exists, that pressure on the spinal cord is not yet present, that the animal with a little assistance is able to rise on its feet and to walk a short distance, it may be well to experiment on the case to the extent of placing the patient in the most favorable circumstances for recovery and allow nature to operate without further interference. This may be accomplished by obtaining immobility of the whole body as much as possible, especially of the suspected region, by placing the patient in slings, in a stall sufficiently narrow to preclude lateral motion, and covering the loins with a thick coat of agglutinative mixture. Developments should then be awaited.

FRACTURE OF THE RIBS

The different regions of the chest are not equally exposed to the violence that causes fractures of the ribs, and they are therefore either more common or more easily discovered during life at some points than at others. The more exposed regions are the middle and the posterior, whereas the front is largely covered and protected by the shoulder. A single rib may be the seat of fracture, or a number may be involved, and there may be injuries on both sides of the chest at the same time. It may take place lengthwise, in any part of the bone, though the middle, being the most exposed, is the most frequently hurt. Incomplete fractures are usually lengthwise, involving a portion only of the thickness of one or other of the surfaces. The complete kind may be either transverse or oblique and are most commonly denticulated. The fracture may be comminuted, and a single bone may show one of the complete and one of the incomplete kind at different points. The extent of surface presented by the thoracic region, with its complete exposure at all points, explains the likelihood of the ribs to suffer from all the forms of external violence.

Symptoms.—In many instances fractures, especially the incomplete variety, of these bones continue undiscovered, without displacement, though the evidences of local pain, a certain amount of swelling, and a degree of disturbance of the respiration, if noticed during the examination of a patient, may suggest a suspicion of their existence. Abnormal mobility and crepitation are difficult to detect, even when present. When there is displacement the deformity that it occasions will betray the fact, and when such an injury exists the veterinarian, in view of possible and probable complications of thoracic trouble, will prepare himself for a case of traumatic pleuritis or pneumonia.

Fatal injuries of the heart are recorded. Subcutaneous emphysema is a common accompaniment of broken ribs.

These hurts are not often of a serious character, though the union is never so solid and complete as in other fractures, the callus being usually imperfect and of a fibrous character, with an amphiarthrosis formation. Still, complications occur that may impart gravity to the prognosis.

Treatment.—Fractures with but a slight or no displacement need no reduction. All that is necessary is a simple application of a blistering nature as a preventive of inflammation or for its subjugation when present, and in order to excite an exudation that will tend to aid in the support and immobilization of the parts. At times, however, a better effect is obtained by the application of a bandage placed firmly around the chest, although, while this limits the motion of the ribs, it is likely to make the respiration more labored.

If there is displacement, with much accompanying pain and evident irritation of the lungs, the fracture must be reduced without delay. The means of effecting this vary according to whether the displacement is outward or inward. In the first case the bone may be straightened by pressure from without, whereas in the second the end of it must be raised by a lever, for the introduction of which a small incision through the skin and intercostal spaces will be necessary. When coaptation has been effected it must be retained by the external application of an adhesive mixture, with splints and bandages around the chest.

FRACTURES OF THE BONES OF THE PELVIS

These fractures are discussed under their separate denominations as those of the sacrum and the hip, which includes the subdivisions of the ilium, the pubis, and the ischium.

SACRUM

Fractures of this bone are rarely seen among equines. Accompanying these fractures there may be paralysis of the pelvic organs and the tail. In such cases the prognosis is usually unfavorable. In the absence of paralysis, reduction is advisable and may sometimes be accomplished by an experienced operator.

HIPBONES

Fractures of the ilium may be observed either at the angle of the hip or at the neck of the bone; those of the pubis may take place at the symphysis, or in the body of the bone; those of the ischium on the floor of the bone, or at its posterior external angle. Or the fracture may involve all three of these constituent parts of the hipbone by having

its situation in the articular cavity—the acetabulum by which it joins the femur or thigh bone.

Symptoms.—Some of these fractures are easily recognized, whereas others are difficult to identify. The ordinary deformity that characterizes a fracture of the external angle of the ilium, its dropping, and the diminution of that side of the hip in width, unite in indicating the existence of the condition expressed by the term “hipped.” An incomplete fracture, however, or one that is complete without displacement, or even one with displacement, often requires the closest scrutiny for its discovery. The animal may show the lameness but little while walking, but on its being urged into a trot will manifest it more and more, until presently it will cease to use the crippled leg altogether and travel entirely on three legs. The acute character of the lameness will vary in degree as the seat of the lesion approximates the acetabulum. In walking, the motion at the hip is very limited, and the leg is dragged; while at rest it is relieved from bearing its share in sustaining the body. A correct conclusion will depend largely on a knowledge of the history of the case; the simple fact of a fall may furnish in a single word a satisfactory solution of the whole matter.

With the exception of the deformity of the ilium in a fracture of its external angle, and unless there has been a serious laceration of tissues and infiltration of blood, or excessive displacement, there are no definite external symptoms in fracture of the hipbone. There is one, however—crepitation—that, in most cases, will not fail. This evidence is attainable by both external and internal examination—by manipulation of the gluteal surface and by rectal taxis. Very often a lateral motion, or balancing of the hinder parts by pressing the body from one side to the other, will be sufficient to make the crepitation more distinct—a slight sensation of grating, which may be perceived even through the thick coating of muscle that covers the bone—and the sensation may not only be felt, but to the expert may even become audible. This external manifestation is, however, not always sufficient in itself, and should invariably be associated with the rectal taxis for corroboration. It is true that this may fail to add to the evidence of fracture, but till then the simple testimony afforded by the detection of crepitation from the surface, though a strong confirmatory point, is scarcely sufficiently absolute to establish more than a reasonable probability or strong suspicion in the case.

In addition to the fact that the rectal examination brings the exploring hand of the veterinarian into near proximity to the desired point of search and to an accurate knowledge of the situation of parts, there is another advantage. This is the facility with which he can avail himself of the help of an assistant, who can aid him by manipulating the implicated leg and placing it in various positions, so far as the patient will permit, while the veterinarian himself is making,

explorations and studying the effect from within. By this method he can hardly fail to ascertain the character of the fracture and the condition of the bony ends. By the rectal taxis he can determine the extent of the fracture of the ilium or of the neck of that bone, to what part of the central portion of the bone (the acetabulum) it reaches, whether this is free from disease or not, and in what location on the floor of the pelvis the lesion is situated. By this method it has frequently been possible to detect a fracture at the symphysis, which, from its history and symptoms and an external examination, could only have been guessed at. Yet, with all its advantages, the rectal examination is not always necessary, as, for example, when the fracture is at the posterior and external angle of the ischium, when by friction of the bony ends the veterinarian may discern the crepitation without it.

Every variety of complication, including muscular lacerations with the formation of deep abscesses and injuries to the organs of the pelvic cavity, the bladder, the rectum, and the uterus, may be associated with fractures of the hip bone.

Prognosis.—The prognosis of these lesions will necessarily vary considerably. A fracture of the most superficial part of the bone of the ilium or of the ischium, especially if there is little displacement, will unite rapidly, leaving a comparatively sound animal often almost free from subsequent lameness. If there is much displacement, however, only a ligamentous union will take place, with much deformity and more or less irregularity in the gait. Other fractures may be followed by complete disability of the patient, as, for example, when the cotyloid cavity is involved, or when the reparatory process has left bony deposits in the pelvic cavity at the seat of the union, which may, in the case of the mare, interfere with the steps of parturition, or induce some local paralysis by pressure on the nerves that govern the muscles of the hind legs. This condition is frequently observed when the callus has been formed on the floor of the pelvis near the obturator foramen, pressing on the course or involving the obturator nerve.

Treatment.—Treatment of all fractures of the hip bone should be of the simplest kind. As this bone is rendered comparatively immovable by the thickness of the muscles by which the region is enveloped, one essential measure suggests itself, and that is to place the animal in a position that, as far as possible, will be fixed and permanent. For the accomplishment of this purpose the best measure is to place the horse in a stall of just sufficient width to admit the animal and to apply a set of slings, snugly but comfortably (pl. XXXI). This will fulfill the essential conditions of recovery—rest and immobility. Blistering applications would be injurious, though the adhesive

mixture might prove in some degree beneficial. The minimum period allowable for solid union in a fractured hip is 2 months.

As has previously been stated, treatment for fracture at the floor of the pelvis is sometimes followed by symptoms of partial paralysis, the animal, when lying down, being unable to regain its feet, but moving freely when placed in an upright position. This condition is due to the interference of the callus with the functions of the obturator nerve, which it presses upon or surrounds. Such an animal may be only temporarily paralyzed; therefore it should not be killed unless remedial measures are shown to be of no avail. With alterations of moderate exercise and rest in slings, and the effect of time while the natural process of absorption is taking effect on the callus with other elements of change that may be so operating, the horse in due time may recover.

FRACTURE OF THE SCAPULA

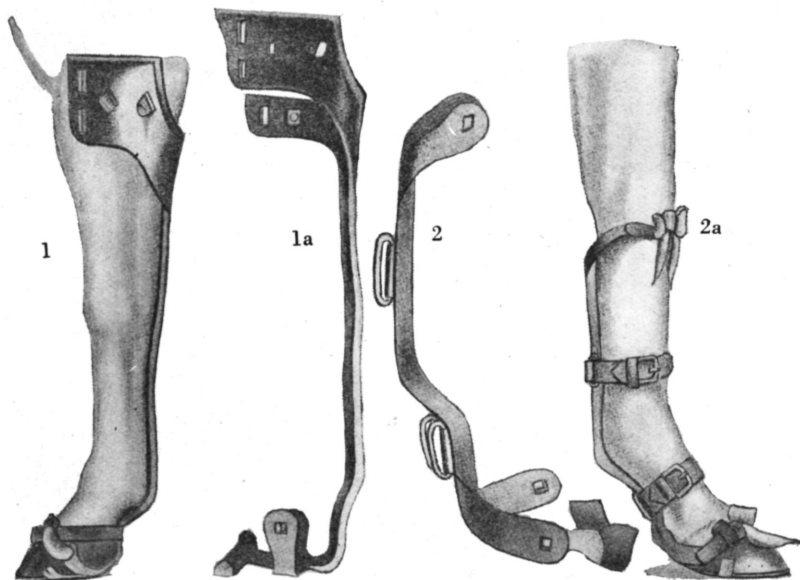
This bone is seldom fractured, its comparative exemption being due to its free mobility and the protection it receives from the superimposed soft tissues. Only direct and powerful causes are sufficient to effect the injury.

Cause.—The causes are heavy blows or kicks and violent collisions with unyielding objects. Those that are occasioned by falls are generally at the neck of the bone, and of the transverse and comminuted varieties.

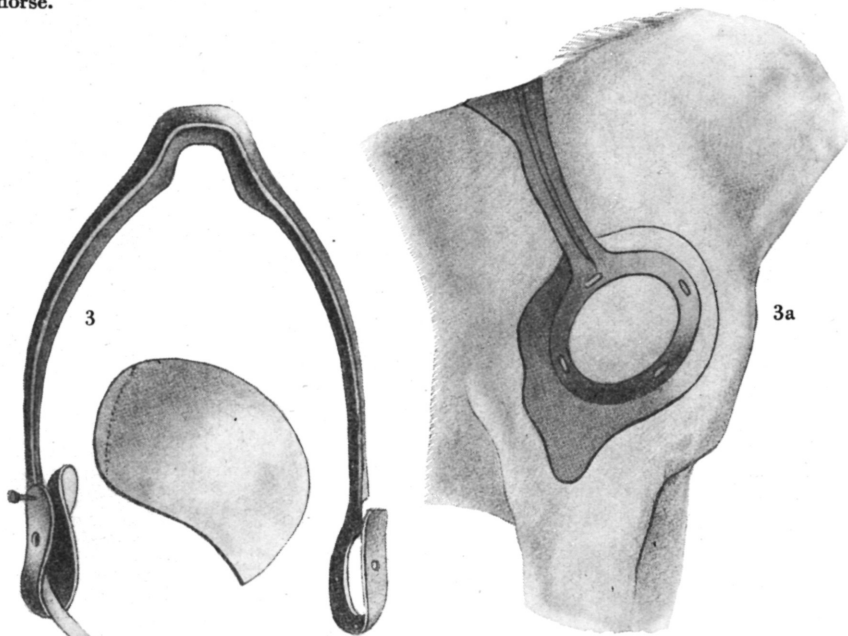
Symptoms.—The diagnosis is not always easy. The symptoms are inability to rest the leg on the ground and to carry weights, and they are present in various degrees from slight to severe. The leg rests on the toe, seems shortened, and locomotion is performed by jumps. Moving the leg while examining it and raising the foot for inspection seem to produce much pain and cause the animal to rear. Crepitation is readily felt with the hand upon the shoulder when the leg is moved. If the fracture occurs in the upper part of the bone, overlapping of the fragments and displacement will be considerable.

The fracture of this bone is usually classed among the more serious accidents, though cases may occur that are followed by recovery without serious ultimate results, especially when the seat of the injury is at some of the upper angles of the bone or about the acromion crest. But if the neck and the joint are the parts involved, complications that may disable the animal for life are likely to be present.

Treatment.—If there is no displacement, a simple adhesive dressing to strengthen and immobilize the parts will be sufficient. A coat of black pitch dissolved with wax and Venice turpentine, and kept in place over the region with oakum or linen bands, will be all the treatment required, especially if the animal is kept quiet in slings.



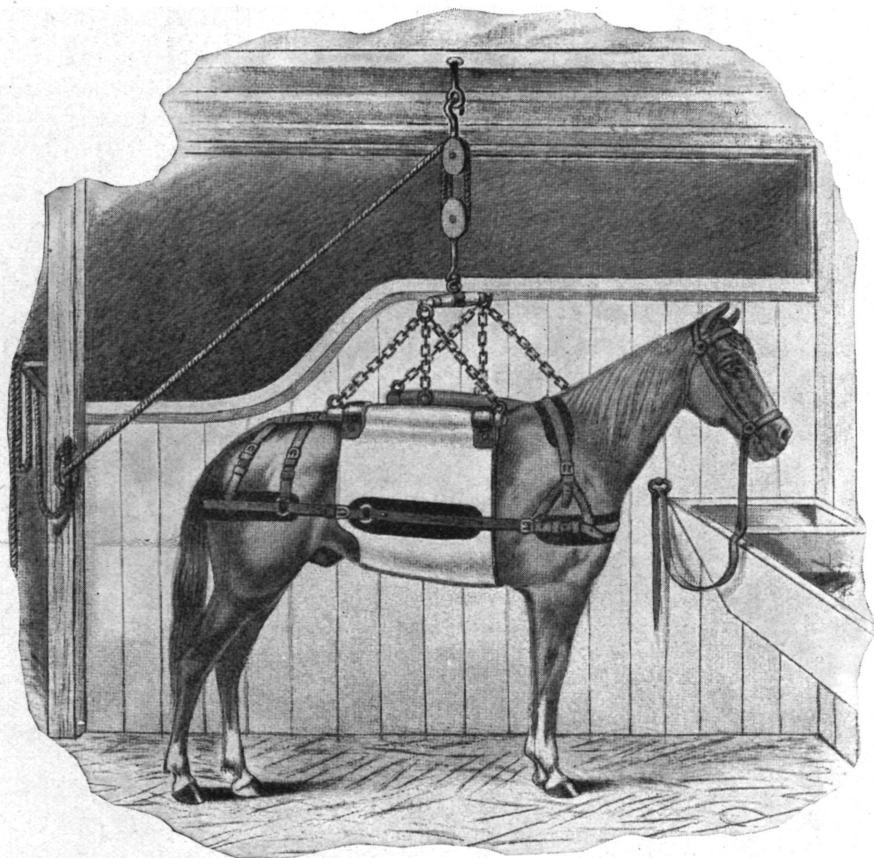
1, Brace for dislocation of the elbow applied to the horse. 1a, The same brace seen alone. 2, Brace for dislocation of fetlock. 2a, The same brace applied to the horse.



Haines, del. after Peuch and Toussaint.

3, Brace for sprained or dislocated shoulder. 3a, The same brace applied to the shoulder.

DISLOCATION OF SHOULDER AND ELBOW.
Bourgelat's apparatus.



Haines, del. after Reynders.

THE SLING IN USE.

Displacement cannot be remedied, and reduction is next to impossible. Sometimes an iron plate is applied over the parts and retained by bandages, as in the dressing of Bourgelat (pl. XXX); this may be advantageously replaced by a pad of thick leather. In smaller animals the parts are retained by figure-8 bandages, covering both the normal and the diseased shoulders, crossing each other in the axilla, and covered with a coating of adhesive mixture.

FRACTURES OF THE HUMERUS

These are more common in small than in large animals and are always the result of external traumatism, such as falls, kicks, and collisions. They are generally very oblique, are often comminuted, and though more usually involving the shaft of the bone will in some cases extend to the upper end and into the articular head.

Symptoms.—There is ordinarily considerable displacement in consequence of the overlapping of the broken ends of the bone, and this of course causes more or less shortening of the leg. There will also be swelling, with difficulty of locomotion, and crepitation will be easy to detect. This fracture is always a serious damage to the patient, leaving it with a permanently shortened leg and an incurable, lifelong lameness.

Treatment.—If treatment is determined on, it will consist in the reduction of the fracture by means of extension and counterextension, to accomplish which the animal must be thrown. If the reduction is successful, the application and adjustment of the apparatus of retention, which must be of the most perfect and efficient kind, then follow. Finally, no matter how skillfully contrived and carefully adapted, this procedure will often fail to effect any good purpose whatever.

FRACTURES OF THE FOREARM

A fracture in this region may also involve the radius or the ulna, the latter being broken at times in its upper portion above the radio-ulnar arch at the olecranon. If the fracture occurs at any part of the forearm from the radio-ulnar arch down to the knee, it may involve either the radius alone or the radius and the ulna, which are there intimately united.

Cause.—Besides having the same cause as most of the fractures, those of the forearm are, nevertheless, more commonly due to kicks from other animals, especially when crowded together in large numbers in insufficient space. Under these circumstances fractures of the incomplete kind are those that occur on the inside of the leg, the bone being in that region almost entirely subcutaneous, whereas those of the complete class are either oblique or transverse. The least common are the longitudinal, in the long axis of the bone.

Symptoms.—This variety of fracture is easily recognized by the appearance of the leg and the different changes it undergoes. There is inability to use it, impossibility of locomotion, mobility below the injury, the ready detection of crepitation—in a word, all the symptoms which have been already considered as associated with the history of broken bones.

The fracture of the ulna alone, principally above the radio-ulnar arch, may be ascertained by the aggravated lameness, the excessive soreness on pressure, and perhaps a certain increase of motion, with a slight crepitation if tested in the usual way. Displacement is not likely to take place except when it is well up toward the olecranon or its tuberosity, the upper segment of the bone being in that case likely to be drawn upward. For a simple fracture of this region there is a fair chance of recovery, but in the compound and comminuted class there is less ground for a favorable prognosis, especially if the elbow joint has suffered injury. A fracture of the ulna alone is not of serious importance, except when the same conditions prevail. A fracture of the olecranon is less amenable to treatment and promises little better than a ligamentous union.

Treatment.—Considering all the various conditions involving the nature and extent of these lesions, the position and direction of the bones of the forearm are such as to render the chances for recovery from fracture as among the best. The reduction, by extension and counterextension; the maintenance of the coaptation of the segments; the adaptation of the dressing by splints, oakum, and agglutinative mixtures; in fact, all the details of treatment may be here fulfilled with a degree of facility and precision not attainable in any other part of the organism. An important, if not an essential, point, however, must be emphasized in regard to the splints. Whether they are of metal, wood, or other material, they should reach from the elbow joint to the ground and should be placed on the posterior face and on both sides of the leg. This is then to be so confined in a properly constructed box as to preclude all possibility of motion, while yet it must sustain a certain portion of the weight of the body. The iron splint (pl. XXX) recommended by Bourgelat is designed for fractures of the forearm, of the knee, and of the cannon bone, and will prove to be an appliance of great value.

FRACTURE OF THE KNEE

This accident is rare, but when it takes place is of a severe character and always accompanied with synovitis, with disease of the joint.

Cause.—It may be caused by falling upon a hard surface and is usually compound and comminuted. Healing seldom occurs, and when it does there is usually a stiffness of the joint from arthritis.

Symptoms.—As a result of this fracture there is inability to bear weight on the foot. The leg is flexed as in complete radial paralysis or fracture of the ulna. There is abnormal mobility of the bones of the knee, but crepitation is usually absent.

Prognosis.—Healing is difficult, one part of the knee is drawn upward by the two flexor muscles that separate it from the lower part. The callus that forms is largely fibrous, and if the animal is put to work too quickly this callus is likely to rupture. In favorable cases healing takes place in 2 or 3 months. Many horses during the treatment develop founder, with consequent drop sole in the sound leg, as a result of pressure due to continuous standing.

Treatment.—Place the animal in slings, bring the pieces of bone together if possible, and try to keep them in place by a tight plaster-of-paris dressing about the leg, extending down to the fetlock. Place the animal in a roomy box stall well provided with bedding so that it can lie down, to prevent founder.

FRACTURE OF THE FEMUR

The protection that this bone receives from the large mass of muscles in which it is enveloped is not sufficient to prevent entirely fracture of this part.

Cause.—It occurs sometimes in consequence of external violence or of muscular contraction; sometimes it takes place at the upper extremity of the bone; sometimes at the lower; sometimes at the head, when the condyles become implicated; but it is principally found in the body or diaphysis. The fracture may be of any of the ordinary forms, simple or compound, complete or incomplete, transverse or oblique. A case of the comminuted variety is recorded in which 85 fragments of bone were removed.

The thickness of the muscular covering sometimes renders the diagnosis difficult by interfering with the manipulation, but the crepitation test is readily available, even when the swelling is considerable, which is likely to be the case as the result of the interstitial hemorrhage that naturally follows the laceration of the blood vessels of the region involved.

Symptoms.—If the fracture is at the neck of the bone, the muscles of that region (the gluteal) are firmly contracted and the leg seems to be shortened in consequence. Locomotion is impossible. There are intense pain and violent sweating at first. Crepitation may in some cases be discerned by rectal examination, with one hand resting over the coxo-femoral (hip) articulation. Fractures of the tuberosities of the upper end of the bone, the great trochanter, may be identified by deformity, swelling, impossibility of rotation, and dragging of the leg in walking. Fracture of the body is always

accompanied with displacement, and as a consequence a shortening of the leg, which is carried forward. The lameness is excessive, the foot being moved, both when raising it from the ground and when setting it down, very timidly and cautiously. The manipulations for the discovery of crepitation always cause much pain. Lesions of the lower end of the bone are more difficult to diagnosticate with certainty, though the manifestation of pain while making heavy pressure upon the condyles will be so marked that only crepitation will be needed to turn a suspicion into a certainty.

Treatment.—At the best the most favorable result that can be expected is a reunion of the fragments with a considerable shortening of the bone, resulting in a limping, crippled animal.

FRACTURE OF THE PATELLA

This is a rare accident and results only from direct violence, as a kick or other blow. The lameness that follows it is accompanied with enormous tumefaction of the joint, pain, inability to bear weight on the foot, and finally disease of the articulation. Crepitation is absent, because the hip muscles draw away the upper part of the bone. The prognosis is unavoidably adverse, destruction being the only termination of this incurable and very painful injury. Most of the reported cases of cures are based on a wrong diagnosis.

FRACTURES OF THE TIBIA

Of all fractures, these are probably more frequently encountered than any others. As with injuries of the forearm of a like character, they may be complete or incomplete; the former when the bone is broken in the middle or at the extremities, and transverse, oblique, or longitudinal. The incomplete kind are more common in this bone than in any other.

Symptoms.—Complete fractures are easy to recognize, either with or without displacement. The animal is very lame, and the leg is either dragged or held completely off the ground by flexion at the stifle, whereas the lower part hangs down. Carrying weight or moving backward is impossible. There is excessive mobility below the fracture and well-marked crepitation. If there is much displacement, as in an oblique fracture, there will be considerable shortening of the leg.

Although incomplete fractures cannot be recognized in the tibia with any greater degree of certainty than in any other bone, there are some facts associated with them by which a diagnosis may be justified. The hypothetical history of a case may serve as an illustration:

An animal has received an injury by a blow or a kick on the inside of the bone, perhaps without showing any mark. Becoming very lame immediately afterwards, it is allowed a few days' rest. When taken out again, the animal seems to have recovered, but within a

day or two it shows a little soreness, which increases until the animal becomes very lame again, to be furloughed once more, with the result of a temporary improvement, and again a return to labor and again a relapse of the lameness; and this alternation seems to be the rule. The leg being now carefully examined, a local periostitis is readily discovered at the point of the injury, the part being warm, swollen, and painful. These symptoms furnish evidence that an incomplete fracture has occurred—a mere split in the bony structure.

The prognosis of fracture of the tibia, as a rule, must be unfavorable.

Treatment.—The difficulty of obtaining a union without shortening, and consequently without lameness, is proof of the futility of ordinary attempts at treatment, but though this may be true in respect to fractures of the complete kind, it is not necessarily so with the incomplete variety, and with this class the use of slings is all that is necessary to obtain consolidation. A few weeks of this confinement will be sufficient.

FRACTURES OF THE HOCK

Injuries of the astragalus that had a fatal termination have been recorded. Fractures of the os calcis have also been observed, but never with a favorable prognosis, and attempts to induce recovery, as might have been expected, have proved futile.

FRACTURES OF THE CANNON BONES

Whether these occur in the fore or hind legs, they appear either in the body or near their extremities. If in the body, as a rule the three metacarpal or metatarsal bones are affected, and the fracture is generally transverse and oblique. On account of the absence of soft tissue and tightness of the skin, the broken bones pierce the skin and make the fracture a complicated one. The diagnosis is easy when all the bones are completely broken, but the incomplete fracture can be only suspected.

Symptoms.—There is no displacement but excessive mobility, crepitation, inability to sustain weight, and the leg is kept off the ground by the flexion of the upper joint.

No region of the body affords better facilities for the application of treatment, and the prognosis on this account is usually favorable. However, a case is known that proved fatal, though under exceptional circumstances. The patient was a valuable stallion of highly nervous organization, with a compound fracture of one of the cannon bones, and his unconquerable resistance to treatment, excited by the intense pain of the wound, precluded all chance of recovery and ultimately caused his death.

Treatment.—The general form of treatment for these lesions will not differ from that already indicated for other fractures. Reduction,

sometimes necessitating the casting of the patient; coaptation, comparatively easy by reason of the subcutaneous situation of the bone; retention, by means of splints and bandages applied on both sides of the region, and reaching to the ground as in fractures of the forearm, these are always necessary. Excellent results have been obtained by the use of a mold of thick gutta-percha, composed of two sections and made to surround the entire lower part of the leg as in an inflexible case.

FRACTURE OF THE FIRST PHALANX

The hind legs are more liable to this injury than the forelegs. It is usually the result of a violent effort or of a sudden misstep or twisting of the leg, and may be transverse, or, as is usually the case, longitudinal, extending from the upper articular surface down to the center of the bone, and generally oblique and often comminuted. The symptoms are the swelling and tenderness of the region (possibly crepitation), a certain abnormal mobility, an excessive degree of lameness, and in some instances a dropping back of the fetlock, with perhaps a straightened or upright condition of the pastern.

The difficulty of reduction and coaptation in this accident and the probability of bony deposits, as of ringbones, resulting in lameness, tend to discourage a favorable prognosis.

The treatment is that which has been recommended for all fractures, so far as it can be applied. The iron splint that has been mentioned gives excellent results in many instances, but if the fracture is incomplete and without displacement, a form of treatment less energetic and severe should be attempted. One case is known in which the owner lost his horse by his refusal to subject the animal to treatment, the post mortem examination revealing only a simple fracture with slight displacement.

FRACTURES OF THE SECOND PHALANX (CORONET)

Though these are generally of the comminuted kind, often conditions are associated with them that justify the veterinarian in attempting their treatment. Though crepitation is not always easy to detect, the excessive lameness, the soreness on pressure, the inability to carry weight, and the difficulty experienced in raising the foot suggest the fracture of the coronet. Because of the structure and surroundings of the coronet, making it immobile, the prognosis may be favorable. Only a slight manipulation will be needed in the treatment of this lesion. To render the immobility of the region more fixed, to support the bones in their position by bandaging, and to establish forced immobility of the entire body with the slings are usually all that is required. Ringbone, being a common sequela of the reparative process, must receive due attention subsequently.

One of the severest complications likely to be encountered is an immobile joint (ankylosis). Neurectomy of the median nerve may relieve lameness after a fracture of the phalanges.

FRACTURES OF THE THIRD PHALANX (OS PEDIS)

These lesions may result from the animal's stepping on a nail, or follow plantar or median neurectomy. In the latter instance it is caused by the animal setting the foot down carelessly and too violently and by degeneration of bone tissue that follows nerving.

Though these fractures are of rather frequent occurrence, their recognition is not easy, and there is more of speculation than of certainty pertaining to their diagnosis. The animal is very lame and spares the injured foot as much as possible, sometimes resting it on the toe alone and sometimes holding it from the ground. The foot is very tender, and the exploring pinchers of the examining veterinarian cause much pain. During the first 24 hours there is no increased pulsation in the digital and plantar arteries, but on the second day it is apparent.

There is nothing to encourage a favorable prognosis, and a usual termination is an ankylosis with either the navicular bone or the coronet.

No method of treatment needs to be suggested here, the hoof performing the office of retention unaided. Local treatment by baths and fomentations will do the rest. It may be months before there is any mitigation of the lameness.

An ultimate recovery depends to a great extent on whether the other foot can support the weight during the healing process without causing a drop sole in the supporting foot.

FRACTURE OF THE SESAMOID BONES

There is evidence to show that this lesion is more frequent than has been supposed. Many observations and careful dissections have revealed that fractures of these little bones have often been mistaken for specific lesions of the numerous ligaments that are implanted on their superior and inferior parts, and that have been described as a "giving way" or "breaking down" of these ligaments. When the attachments of the ligaments were torn from their bony connections it has been found that minute fragments of bony structure were also separated, though no diseased process of the fibrous tissue composing the ligamentous substance was detected.

Cause.—From whatever cause this lesion may arise, it can hardly be considered as of a traumatic nature, no external violence having any apparent agency in producing it. It is likely due to a peculiar degeneration or softening of the bones themselves. The disease is a

peculiar one, and the suddenness with which different feet are successively attacked, at short intervals and without any obvious cause, seems to prove the existence of some latent, morbid cause that has been unsuspectedly incubating. It is not peculiar to any particular class of horses nor to any special season of the year.

Symptoms.—It generally makes its appearance without premonition in animals that, after having had a considerable period of rest, are first exercised or put to work, though it may manifest itself while the horse is still idle in the stable. When an animal that has been at rest is taken out to work, it may presently be noticed that there is something unusual in its movements. Its gait is changed, and it travels with short, mincing steps, without any of its accustomed ease and freedom. This may continue until the return to the stable, and then, after the animal is placed in the stall, it will be noticed shifting the weight from side to side and from one leg to another, continuing the movement until rupture of the bony structure takes place. But the lameness in one or more of the extremities, anterior or posterior, may suddenly increase, and it becomes evident that the rupture has taken place in consequence of a misstep or a stumble while the horse was at work. Then, on coming to a standstill, the animal will have one or more of its toes turned up; it is unable to place the affected foot flat on the ground. The fetlock has dropped and the leg rests on this part, the skin of which may have remained intact or may have been more or less extensively lacerated. More than one toe at a time seldom turns up, yet the lesion in one will be followed by its occurrence in another. Commonly two feet, either the fore or hind, are affected, and at least one case is known in which the two fore and one of the hind legs were included at the same time. The accident, however, is as likely to happen while the horse is at rest in the stall, and it may be found in the morning standing on the fetlocks. One case had been under care for several weeks for suspected disease of the fetlocks, the nature of which had not been determined, when, apparently improved by the treatment, the patient was taken out of the stable to be walked a short distance into the country. It had little more than started when it was called to a halt by the fracture of the sesamoids of both forelegs.

Although no positive premonitory symptoms of these fractures are known, there are symptoms that always justify a strong suspicion of them. These are soreness in standing, a short mincing gait, and tenderness manifested when pressure is made over the sesamoids on the sides of the fetlock.

Prognosis.—These injuries are serious and usually fatal. If the cause of the lesions really is the softening of the sesamoidal bony structure and independent of any changes in the ligamentous fibers, a solid osseous union seems impossible.

Treatment.—In respect to the treatment to be recommended and instituted it can be employed with any rational hope of benefit only during the incubation and with the anticipatory purpose of prevention. It must be applied before any rupture has taken place. To prevent this, resort must be had to slings and to the application of firm bandages or splints, perhaps of plaster of paris, with a high shoe. When the fracture has occurred, and the toes, one or more, are turned up, any further resort to treatment will be futile.

DISEASES OF JOINTS

Three classes of injury are considered under this head. These are affections of the synovial sacs, those of the joint structures or of the bones and their articular surfaces, and dislocations or luxations.

DISEASES OF THE SYNOVIAL SACS

Two forms of affection here present themselves, one being the result of an abnormal secretion that induces a dropsical condition of the sac without any acute, inflammatory action. The other is characterized by excessive inflammatory symptoms, with their modifications, constituting synovitis.

SYNOVIAL DROPSIES

Consideration has already been given in a general way to the presence of these peculiar oil bags in the joints and in some regions of the legs where the passage of the tendons takes place. There is a similarity of structure and function of both the articular and the tendinous bursae, as well as the cause of the injuries and their pathological history and a discussion of the affections of both as here presented.

WINDGALLS

This name is given to the dilated bursae found at the posterior part of the fetlock joint. They have their origin in a dropsical condition of the bursae of the joint itself, also of the tendon that slides behind it, and are therefore further known by the designations of articular and tendinous windgalls, or puffs. (See p. 375.)

They appear in the form of soft and somewhat symmetrical tumors, of varying dimensions, and generally well defined in their circumference. They are more or less tense, according to the quantity of secretion they contain, apparently becoming softer as the foot is raised and the fetlock flexed. Usually they are painless and cause lameness only under certain conditions, as when they begin to develop under the stimulus of inflammatory action, or when large enough to interfere with the functions of the tendons, or again when they have undergone certain pathological changes, such as calcification, which is among their tendencies.

Cause.—Windgalls may be attributed to external causes, such as severe labor or strains resulting from heavy pulling, fast driving, or jumping, or they may be among the sequelae of internal disorders, such as strangles or the results of a pleuritic or pneumonic attack.

Unnecessary anxiety is sometimes experienced respecting these growths, with much questioning concerning the expediency of their removal, all of which might be spared, for, while they constitute a blemish, their unsightliness will not hinder the usefulness of the animal, and in any case they are usually easily amenable to treatment.

Treatment.—When in the acute stage and when the dropsical condition is not excessive, the inflammation may be checked during the day by continuous, cold-water irrigation by means of a hose or soaking tub and at night by applying a moderately tight-roller bandage. Later absorption may be promoted by a Priessnitz bandage,¹ pressure by roller bandages, sweating, the use of liniments, or if necessary by the use of a sharp blistering agent. This treatment may subdue the inflammation, abate the soreness, absorb the excess of secretion, strengthen the walls of the sac, and finally cause the windgalls to disappear, provided the animal is not too quickly returned to labor and exposed to the same factors that occasioned them at first.

If the inflammation has become chronic, however, and the enlargement has been of considerable duration, the negative course will be the wiser one. If any benefit results from treatment it will be of only a transient kind, the dilatation returning when the patient is again subjected to labor, and it will be a fortunate circumstance if inflammation has not supervened.

Notwithstanding the generally benignant nature of the swelling there are exceptional cases, usually when it is probably undergoing certain pathological changes, that may result in lameness and disable the animal, in which case surgical treatment will be necessary, especially if repeated blistering has failed to improve the symptoms. Line firing is then resorted to. This operation, timely performed, has restored the usefulness of many affected animals. Another method of firing, which consists in emptying the sac by means of punctures through and through, made with a red-hot needle or wire, and the subsequent injection of certain irritating and alterative compounds into the cavity, designed to effect its closure by exciting adhesive inflammation, such as tincture of iodine, may be commended. But they are all too active and energetic in their effects and require too much special attention and intelligent management to be trusted to any hands other than those of an expert veterinarian.

¹ This bandage consists of a cloth drenched in warm water or a dripping bandage laid around the diseased part, then covered by several layers of woolen blanket or cloth, which is in turn covered by parchment paper, rubber cloth, or other impervious material. Heat, moisture, and pressure are obtained by such a bandage if water is poured upon it several times daily.

BLOOD SPAVIN, BOG SPAVIN, AND THOROUGHPIN

The blood spavin is situated in front and to the inside of the hock and is merely a varicose or dilated condition of the saphena vein. It occurs directly over the point where the bog spavin is found and has thus been frequently confused with the latter.

The complicated arrangement of the hock joint, and the powerful tendons that pass on the posterior part, are lubricated with the product of secretion from one tendinous synovial and several articular synovial sacs. A large articular sac contributes to the lubrication of the shank bone (the tibia) and one of the bones of the hock (the astragalus). The tendinous sac lies back of the articulation itself and extends upward and downward in the groove of that joint through which the flexor tendons slide. The dilatation of this articular synovial sac is called bog spavin, the term "thoroughpin" being applied to the dilatation of the tendinous capsule.

The bog spavin is a round, smooth, well-defined, fluctuating tumor situated in front and a little inward of the hock. On pressure it disappears at this point to reappear on the outside and just behind the hock. If pressed to the front from the outside it will then appear on the inside of the hock. On its outer surface it presents a vein that is quite prominent, running from below upward, and it is to the preternatural dilatation of this blood vessel that the term "blood spavin" is applied.

The thoroughpin is found at the back and on the top of the hock in that part known as the hollows, immediately behind the shank bone. It is round and smooth but not so regularly formed as the bog spavin and is most apparent when viewed from behind. The swelling is usually on both sides and a little in front of the so-called hamstring but may be more noticeable on the inside or on the outside.

In their general characteristics bog spavins and thoroughpins are similar to windgalls, and one description of the origin, symptoms, pathological changes, and treatment will serve for all equally, except that it is possible for a bog spavin to cause lameness and thus to involve a verdict of unsoundness in the patient, a circumstance that will, of course, justify its classification by itself as a severer form of a single type of disease.

Reference has already been made to the subject of treatment and the means employed—rest, of course—with liniments, blisters, etc., and what is regarded as the most active and beneficial of any—early, deep, and well-performed cauterization. There are, besides, commendatory reports of a form of treatment by the application of pressure pads and peculiar bandages on the hocks, and it is asserted by some that the removal of the tumors has been effected by their use. However, these methods are not recommended.

OPEN JOINTS, BROKEN KNEES, SYNOVITIS, AND ARTHRITIS

Because of the close relationship that exists among these several affections, their apparently possible connection as successive developments of a similar, if not an essentially identical, origin, and the fact that symptoms and treatment are much the same, these ailments have been grouped together in the present section.

Cause.—Blows, bruises, hurts by nearly every known form of violence, falls, kicks, lacerations, punctures, compulsory speed in racing, and overloading of draft animals are the causes of the diseases and injuries of the joints now receiving consideration.

In one case, a working horse making a misstep stumbles, and falling on its knees receives a hurt, varying from a mere abrasion of the skin to a laceration, a division of the tegument, a slough, mortification, and the escape of the synovial fluid, with or without exposure of the bones and their articular cartilages.

In another case, an animal, from one cause or another, perhaps an impatient temper, had formed the habit of striking or pawing the manger with its forefeet until inflammation of the knee joint is induced, first as a little swelling, diffused, painless; then as a periostitis of the bones of the knee; later as bony deposits, then lameness, and finally the implication of the joint, with all the various sequelae of chronic inflammation of the knee joint.

In another case, a horse had received a blow with a fork from a careless attendant on or near a joint, or has been kicked by another horse, with the result of a punctured wound, at first mild-looking painless, apparently without inflammation, and not yet causing lameness, but which, in a few hours, or perhaps in a few days, becomes excessively painful, grows worse, the entire joint swells, presently discharges, and at last a case of suppurative synovitis is presented, with perhaps disease of the joint proper, and arthritis as a climax. The symptoms of articular injuries vary not only in the degrees of the hurt but also in the nature of the lesion.

Or the condition of broken knees, may have for its starting point a mere abrasion of the skin—a scratch, apparently, that disappears without a scar. The injury may, however, have been more severe, the blow heavier, the fall aggravated by occurring on an irregular surface or sharp or rough object, with tearing or cutting of the skin, and this laceration may remain. This case is more serious than the first.

Another time, immediately after the accident, or possibly as a sequel of the traumatism, the tendinous sacs may be opened, with the escape of the synovia, or, worse, the tendons that pass in front of the knee, are torn, the inflammation spreads, the joint and leg are swollen, the animal is becoming very lame; synovitis has set in. With this the danger becomes very great, for soon suppuration will be

established, then the external coat of the articulation proper becomes ulcerated, if it is not already in that state, and an open joint results with suppurative synovitis—that is, with the worst among the conditions of diseased processes, because of the likelihood of the suppuration to become infiltrated into every part of the joint, macerating the ligaments, and irritating the cartilages, soon to be succeeded by their ulceration, with the destruction of the articular surface—or the lesion of ulcerative arthritis, one of the gravest among animal diseases.

Ulcerative arthritis and suppurative synovitis may develop otherwise than in connection with open joints; the simplest and apparently most harmless punctures may be sufficient cause. For example, a horse may be kicked, perhaps, on the inside of the hock; there are a mark and a few drops of blood to indicate the spot; the animal is put to work apparently free from pain or lameness and performs its task with the usual ease and facility. On the following morning, however, the hock is a little swollen and there is some stiffness. A little later on, the animal manifests uneasiness in the leg and shrinks from resting weight upon it, moving it up and down for relief. The swelling has increased and is increasing; the pain is severe; and finally, at the spot where the kick occurred, there is an oozing of an oily liquid mixed with whitish drops of suppuration. A simple, harmless, punctured wound has developed into a case of ulcerative arthritis and suppurative synovitis.

Prognosis.—The lesions are of a serious character, irrespective of which joint is affected. Yet there will be modifications in the prognosis in different cases, in accordance with the peculiarities of structure in the joint specially involved, as, for example, a better result may be expected from treatment when but a single joint, with only its plain articular surfaces, is the place of injury, than in one composed of several bones, united in a complex formation, as in the knee or hock. As severe as suppurative synovitis always is, and as frequently fatal as it proves to be, still cases arise in which the inflammation assumes a modified character and at length subsides, and the animal is left with a comparatively sound and useful joint. There are cases, however, that result in the union of the bones and occlusion of the joint, to form an ankylosis, which is scarcely a condition to justify a high degree of satisfaction, as it insures a permanent lameness with little capacity for usefulness.

In view of the dangers associated with all wounds of articulations, however simple and apparently slight, and of the seriousness of the complications that are likely to arise during their progress and treatment, prompt attention to their discovery and diagnosis is very important.

Treatment.—For simple bruises, like those that appear in the form of broken knees, simple remedies, such as warm fomentations or cold-

water applications and compresses of astringent mixtures, suggest themselves at once. Injuries of a more complicated character, as lacerations of the skin or tearing of soft structures, will also be benefited by simple dressings with antiseptic mixtures. The escape of synovia should suggest the prompt use of collodion dressings to check the flow and prevent the further escape of the fluid. But if the discharge is abundant and heavily suppurative, little more can be done than to use warm fomentations, repeatedly applied, and soothing, mucilaginous poultices. Improvement, if any is possible, will be slow. The most difficult of all things to do, in view of varying interests and opinions—that is, in a practical sense—is to abstain from “doing” entirely, and yet noninterference is the best and wisest policy.

In cases that terminate successfully, the discharge will diminish by degrees, the extreme pain will gradually subside, the convalescent will begin timidly to rest the foot on the ground and presently to bear weight upon it, and perhaps, after a long and tedious process of recuperation, the animal may be returned to its former usefulness. When the discharge has wholly ceased and the wounds are entirely healed, a blistering agent covering the entire joint for the purpose of stimulating the absorption of the exudation will be of great service. If, on the contrary, there is no amelioration of symptoms and the progress of the disease resists every attempt to check it, if the discharge increases and flows from a number of fistulous tracts that have successively formed, if it seems evident that this drainage is rapidly and painfully sapping the animal's vitality, it may be both humane and economical to destroy the animal.

One of the essentials of treatment, and probably an indispensable condition when recovery is in any wise attainable, is the suspension of the patient in slings. The animal should be continued in them as long as it can be made to submit quietly to their restraint.

DISLOCATIONS

Dislocations and luxations are interchangeable terms, meaning the separation and displacement of the articulating surfaces of the bones entering into the formation of a joint. This injury is rarely encountered in horses on account of the combination of strength and solidity in the formation of their joints.

Causes.—Among the predisposing causes in animals are caries of articular surfaces, articular abscesses, excessive dropsical conditions, degenerative softening of the ligaments, and any excessive laxity of the soft structures.

Symptoms and diagnosis.—Three signs of dislocation must usually be taken into consideration. They are: (1) An alteration in the shape of the joint and in the normal relationship of the articulating sur-

faces; (2) an alteration in the length of the leg, either shortening or lengthening; (3) an alteration in the movableness of the joint, usually an unnatural immobility. Only the first, however, can be relied upon as essential. Dislocations are not always complete; they may be partial; that is, the articulating surfaces may be displaced but not separated. In such cases several symptoms may not be present. And not only may the third sign be absent, but the mobility of the first be greatly increased when the character of the injury has been such as to produce extensive lacerations of the articular ligaments.

In addition to the above signs, a dislocation is usually characterized by pain, swelling, hemorrhage beneath the skin from damaged or ruptured blood vessels, and even paralysis, when important nerves are pressed on by the displaced bones.

Sometimes a bone is fractured in the immediate vicinity of a joint. It is necessary, therefore, to be able to diagnose between a dislocation and such a fracture. There are generally three points to assist in this: (1) The immobility of a dislocated joint in comparison with the apparently remarkable freedom of movement in fracture; (2) in a dislocation there is no true crepitus—that peculiar grating sensation heard as well as felt on rubbing together the rough ends of fractured bones; however, in a dislocation 2 or 3 days old the inflammatory changes around the joint may give rise to a crackling sensation similar to that in fracture; (3) as a rule, in dislocations, if the ligamentous and muscular tissues about the joint are not badly torn, the displacement, when reduced, does not recur.

Prognosis.—The prognosis of a dislocation is less serious than that of a fracture, though the treatment may be so difficult to apply that complications of a very severe character may arise.

Treatment.—The treatment of dislocations is similar to that of fractures. Reduction, naturally, will be the first step in both cases, and the retention of the replaced parts must follow. The reduction involves the same steps of extension and counterextension, performed in the same manner, with the patient subdued by anesthetics.

In the reduction of a dislocation, the object is simply to restore the bones to their normal position, with each articular surface in exact contact with its companion surface. The apparatus necessary to keep them in place is similar to that employed in fractures. It must usually be retained for 40 to 50 days, if not longer, before the ruptured retaining ligaments are sufficiently firm to perform their work unassisted. A variety of manipulations must be used by the veterinarian, consisting in pushing, pulling, pressing, rotating, and indeed, whatever movement may be necessary, until the bones are forced into such relative positions that the muscular contraction, operating in just the right directions, pulls the opposite matched ends together in true coaptation—

a head into a cavity, an articular eminence into a trochlea, as the case may be. The "setting" is accompanied with a peculiar, snapping sound, audible and significant, as well as a visible return of the surface to its normal symmetry.

SPECIAL DISLOCATIONS

Although it is possible for all the articulations of the body to be dislocated, there are three that merit special consideration:

THE SHOULDER JOINT

The superior head of the arm bone as it is received into the lower cavity of the shoulder blade is so situated as to be likely to be forced out of place in four directions. It may escape from its socket, according to the manner in which the violence affects it—outward, inward, backward, or forward—and the deformity that results and the effects that will follow will correspondingly differ. Treatment is generally unsuccessful. The difficulties in the way of reduction are nearly insurmountable, and the application of means for the retention of the parts after reduction is next to impossible. The prognosis, from any point of view, is exceedingly grave.

THE HIP JOINT

The characteristics of this joint are much like those of the humero-scapular articulation, but the former is more strongly built. The head of the thigh bone is more separated, or prominent and rounder in form, and the cuplike cavity, or socket, into which it fits is much deeper, forming together a deep, true ball-and-socket joint, which is, moreover, reenforced by two strong cords of funicular ligaments, which unite them. Consequently, dislocation of the hip joint is comparatively rare; yet cases are recorded in which the head of the bone has been affirmed to slip out of its cavity and assume various positions—inward, outward, forward, or backward.

Treatment is like that for all cases of dislocation. When the reduction is accomplished, the fact is indicated by the peculiar snapping sound usually heard on such occasions.

PSEUDO-DISLOCATIONS OF THE PATELLA

This is not a true dislocation. The stifle bone is so peculiarly articulated with the thigh bone that the means of union are of sufficient strength to resist the causes which usually give rise to dislocations, yet there is sometimes a peculiar, pathological state in the hind legs of animals, the effect of which closely resembles the manifestation of many of the general symptoms of dislocations. This condition originates in muscular cramps, the action of which is seen in a certain change in the coaptation of the articular surfaces of the

stifle and thigh bone, resulting in sudden and alarming series of symptoms that have suggested the phrase of "stifle out" as a descriptive term.

Symptoms.—The animal so affected stands quietly and firmly in the stall, or perhaps with one hind leg extended backward. The animal resists every attempt to move it backward, and if urged to move forward it will either refuse or comply with a jump, with the toe of the disabled leg dragging on the ground and brought forward by a second effort. There is no flexion at the hock and no motion at the stifle, while the circular motion of the hip is quite free. The leg appears to be much longer than the other, owing to the straightened position of the thigh bone, which forms almost a straight line with the tibia from the hip joint down. The stifle joint is motionless, and the motions of all the joints below it are more or less interfered with. External examination of the muscles of the hip and thigh reveals a certain degree of rigidity, with perhaps some soreness, and the stifle bone projects more or less on the outside and upper part of the joint.

This condition may continue for some time and until treatment is applied, or it may spontaneously and suddenly terminate, leaving everything in its normal condition, but perhaps to return again.

Cause.—Pseudodislocation of the patella is likely to occur under many of the conditions that cause actual dislocation, and yet it may often occur in animals that have not been exposed to the ordinary causes but that have remained at rest in their stables. Sometimes these cases are assignable to falls in a slippery stall, or perhaps slipping when endeavoring to rise; sometimes to weakness in convalescing patients; sometimes to lack of tonicity of structure and general debility; sometimes to relaxation of tissues from want of exercise or use. A straight leg, sloping croup, and young animals are predisposed to this dislocation.

Treatment.—The reduction of these displacements of the patella is not usually difficult. A sudden jerk or spasmodic action will often be all that is required to spring the patella into place, when the flexion of the leg at the hock ends the trouble for the time. But this is not always sufficient, and a true reduction may still be necessary. To effect this, the leg must be drawn well forward by a rope attached to the lower end, and the patella, grasped with the hand, forcibly pushed forward and inward and made to slip over the outside border of the trochlea of the femur. The bone suddenly slips into position, the excessive rigor of the leg ceases with a spasmodic jerk, and the animal may walk or trot away without suspicion of lameness. Though this may end the trouble for the time, and the restoration seem to be perfect and permanent, a repetition of the trouble may subsequently take place. Perhaps from the loss of some tensile power that would

naturally follow the original attack in the muscles involved, the lesion might become a habitual weakness.

Warm fomentations and douches with cold water often promote permanent recovery, and liberty in a box stall or in the field in many cases insure constant relief. The use of a high-heeled shoe is recommended by European veterinarians. The use of stimulating liniments, with frictions, charges, or even severe blisters, may be resorted to in order to prevent the repetition of the difficulty by strengthening and toning up the parts.

INJURIES AND DISEASES OF MUSCLES AND TENDONS

SPRAINS

The term "sprains" expresses a more or less complete laceration or yielding of the fibers of the muscles, tendons, or the sheaths surrounding and supporting them. The usual cause of a sprain is external violence, such as a fall or a powerful exertion of strength, with following symptoms of soreness, heat, swelling, and a suspension of function. Their termination varies from simple resolution to suppuration, and commonly fibrinous exudation difficult to remove. None of the muscles or tendons of the body are exempt from liability to this lesion, though naturally from their uses and the exposure of their situation the extremities are more likely than other regions to become their seat. The nature of the prognosis will be determined by a consideration of the seat of the injury and the complications likely to arise.

Treatment.—Treatment consists of local applications, including warm fomentations, stimulating liniments, counterirritation by blistering, and in some cases even firing. Rest, in the stable or in a box stall, will be of advantage by promoting the absorption of whatever fibrinous exudation may have formed, or absorption may be stimulated by the careful persevering application of iodine in the form of ointments of various degrees of strength.

There are many conditions in which not only the muscular and tendinous structures proper are affected by a strain, but, by contiguity of parts, the periosteum of neighboring bones may become involved, with a complication of periostitis and its sequelae.

LAMENESS OF THE SHOULDER

Lameness of the shoulder from sprains occurs frequently. Though so well covered with muscles, the shoulder is often the seat of injuries which, from the complex structure of the region, become difficult to diagnosticate with satisfactory precision and facility. The flat bone that forms the skeleton of that region is articulated in a comparatively loose manner with the bone of the arm, but the joint is, notwith-

standing, rather solid, and is powerfully strengthened by tendons passing outside, inside, and in front of it. Still, shoulder lameness or sprain may exist, originating in lacerations of the muscles, the tendons or the ligaments of the joint, or perhaps in diseases of the bones themselves. "Slip of the shoulder" is a phrase frequently applied to such lesions.

The identification of the particular structures involved in these lesions is of much importance, in view of its bearing on prognosis. For example, although a simple superficial injury of the spinatus muscles, or the muscles by which the leg is attached to the trunk, may not be serious and may readily yield to treatment, or even recover spontaneously and without interference, the condition is quite changed in a case of tearing of the flexor brachii, or of its tendons as they pass in front of the articulation, or, what is still more serious, if there is inflammation or ulceration in the groove over which this tendon slides, or upon the articular surfaces or their surroundings, or periostitis at any point adjacent.

Causes.—The frequency of attacks of shoulder lameness is not difficult to account for. The superficial and unprotected position of the part and the numerous movements of which it is capable, and which, in fact, it performs, render it liable to accident or injury. Among the forms of violence by which the shoulder may be crippled are the following: A fall, accompanied with powerful concussion; a violent muscular contraction in starting a heavily loaded vehicle; a misstep following a quick muscular effort; a jump accompanied with miscalculated results in alighting; a slip on a smooth, icy road; balling the feet with snow; and colliding with another horse or other object.

Symptoms.—Some of the symptoms of shoulder lameness are peculiar to themselves, and yet the trouble is frequently mistaken for other affections—navicular disease more often than any other. The fact that in both affections there are instances when the external symptoms are imperfectly defined, and that one of them especially is similar in both, is sufficient to mislead careless or inexperienced observers and to occasion the confusing of the two diseases.

Shoulder lameness manifests itself by signs and appearances more or less distinct and pronounced, according to the nature of the degrees and the extent of the originating cause. Some of these signs and appearances are as follows:

The lameness is continued, the disturbance of motion determining the severity of the lesion and its extent. It is more marked when the bones are involved than when the muscles alone are affected. When in motion the two upper bony levers—the shoulder blade and the bone of the upper arm—are reduced to nearly complete immobility and the walking is performed by the complete displacement of the

entire mass, which is dragged forward without either flexion or extension. The action of the joint below, as a natural consequence, is limited in its flexion. In many instances there is a certain degree of swelling at the point of injury—at the joint, or, more commonly, in front of it, or on the surface of the spinatus muscle. Again, instead of swelling there will be muscular atrophy. Although the loss of muscular power may interfere with perfect locomotion, it is not in itself usually a cause of shoulder lameness. “Sweenied” shoulders are more often due to disease below the fetlock than to affections above the elbow.

During rest the animal often carries the leg forward, somewhat analogous to the “pointing” position of navicular disease, though in some cases the painful member drops at the elbow in a semiflexed position. The backing is sometimes typical, the animal when performing it, instead of flexing the shoulder, drags the whole leg without motion in the upper segment of the extremity.

The peculiar manner in which the leg is brought forward in the air for another step in the act of walking or trotting is in some instances characteristic of injuries of the shoulder. The lameness also manifests itself in bringing the leg forward with a circumflex swinging motion and a shortening in the extension of the step. The foot is carried close to the ground and stumbling is frequent, especially on an uneven road.

Because of the vagueness and uncertainty of the symptoms, sometimes the expedient is tried of aggravating the symptoms by way of intensifying their significance and thus rendering them more intelligible. This has been done by making the animal travel on hard or very soft ground and compelling it to turn on the sound leg as a pivot, with other motions calculated to find the locality of the pain.

Treatment.—Lameness of the shoulder often disappears with no prescription other than that of rest. Provided the lesions occasioning it are not too severe, time is all that is required. In cases in which treatment seems advisable, water may be used, as a cold douche or by showering, or by warm fomentations. Warm, wet blankets are of great service; in addition, or as an alternative, anodyne liniments are of benefit, and at a later period stimulating friction with suitable mixtures, sweating liniments, or blistering compounds may be used, and finally, when necessity demands it, the firing iron.

The duration of the treatment must be determined by its effects. However, the essential procedure to be followed, and the one without which the possibility of relapse will always remain as a menace, is rest, irrespective of any other prescriptions with which it may be associated.

SPRAIN OF THE ELBOW MUSCLES

Causes.—This injury, which fortunately is not common, is mostly encountered in cities among heavy draft horses or rapidly driven animals that are obliged to travel, often smooth shod, on slippery pavements, where they are likely to lose their footing. The region of the strain is the posterior part of the shoulder, and the affected muscles are those that occupy the space between the posterior border of the scapula and the posterior face of the arm. The muscles of the olecranon are those that give way.

Symptoms.—The symptoms are easily recognized, especially when the animal is in action. While at rest the attitude may be normal, or by close scrutiny a peculiarity may perhaps be detected. The leg may seem to drop; the elbow may appear to be lower than its fellow, with the knee and lower part of the leg flexed and the foot resting on the toe, with the heel raised. Such an attitude, however, may be occasionally assumed by an animal without having any special significance, but when it becomes more pronounced in motion the fact acquires a symptomatic value, and this is the case in the present instance. A rapid gait becomes impossible, and the walk, as in some few other diseases, becomes sufficiently characteristic to warrant a diagnosis even when observed from a distance. An entire dropping of the anterior part of the trunk becomes manifest, and no weight is carried on the disabled side in consequence of the loss of action in the suspensory muscles. There are often heat, pain, and swelling in the muscular mass at the elbow, though at times a hollow, or depression, may be observed near the posterior border of the scapula, which is probably the seat of injury.

These hurts are of various degrees of importance, from mere minor casualties of quick recovery to lesions that are of sufficient severity to render an animal useless for life.

Treatment.—The principal treatment, which should be strictly observed, is rest and quiet. Prescriptions of all kinds have their uses. Among them are anodyne liniments, warm fomentations, and blisters. Recovery depends to a great extent, on rest, of which there are degrees. One is simple immobility in a narrow stall. Another involves the enforced immobility of the slings and a narrow stall as well; another a box stall, with ample latitude as to posture and space, and option to stand or lie down. As wide as this range may appear to be, recovery has occurred under all these modified forms of *letting the animal alone*.

HIP LAMENESS

Causes.—The causes of hip lameness are, in general, the same as those of the shoulder, except in respect to the affection known as morbus coxarius, or hip-joint disease.

Symptoms.—In examining the outlines of the joint and the region adjacent for any difference of size or disturbance of symmetry in the parts, any prominence or rotundity, and on both sides, the lame side will probably be warmer, more developed, and fuller, both to the touch and to the eye. If the lower part of the leg is grasped (in examining a case of shoulder lameness), pain will probably result when the leg is made to assume a given position. Pushing the thigh forcibly against the hip bone will probably cause a manifestation of pain. If the horse is trotted, the limited action of the hip joint proper and the excessive dropping and rising of the hip of the opposite side will be easily recognized. Usually the animal does not extend the foot so far as customarily and picks it up much sooner.

The abductive or circumflex motion observed in shoulder lameness is also present in hip lameness, but under special conditions, and the test of the difficulty, either by traveling on soft ground or in turning the horse in a circle, may here also contribute to the diagnosis, as in testing for lameness in the anterior extremity.

Prognosis.—The prognosis of hip lameness is at times serious, not only on account of the long duration of treatment required to effect good results, and because of the character that may be assumed by the disease, but also of the permanence of the disability resulting from it. Exostosis and ulcerative arthritis are sequelae that often resist every form of treatment.

Treatment.—The advantages of rest are the same as in shoulder lameness, and the same local applications may be used. The latter are likely to be more effective than in shoulder lameness and may be more freely employed, whether in the form of liniments, blistering agents, (singly or repeated), or firing.

SPRAINS OF SUSPENSORY LIGAMENTS AND OF FLEXOR TENDONS OR THEIR SHEATHS

The fibrous structure situated behind the cannon bones, both in the fore and hind legs, is often the seat of lacerations or sprains resulting from violent efforts or sudden jerks.

Cause.—The injury may be serious or trifling, according to the circumstances of each case as judged by its own history. Among the predisposing causes are a long, thin fetlock and a narrow knee or hock as viewed from the side, with the flexor muscles tied in just below the joint. The longer and more oblique the pastern the greater is the strain on the flexor tendons and suspensory ligaments; hence a low quarter, a toe calk, and no heel calks, or a thin calk placed at the tip under the toe, and leaving the quarters long, abnormally stretch the back tendons and cause a great strain on them just before the weight is shifted from the foot in locomotion. In runners and hunters the disease is likely to be periodic. In driving horses it is most com-

mon in well-bred animals of nervous temperament. Draft horses suffer most frequently in the hind legs.

Symptoms.—The injury is readily recognized by the changed aspect of the region and the accompanying local symptoms. The parts that in health are well defined, with the outlines of the tendons and ligaments well marked, become the seat of a swelling, more or less developed, from a small spot on the middle of the back of the tendon to a tumefaction reaching from the knee down to and even involving the fetlock itself. It is always characterized by heat, and it is sensitive, ranging in degree from a mere tenderness to a soreness that causes the animal to shrink from the lightest touch. The degree of the lameness varies, and it has a corresponding range with the soreness, sometimes being only a slight halting and at others the extreme of lameness on three legs, with intermediate degrees.

The lameness is always worse when the weight is thrown on the foot and is most marked toward the end of the phase of contact with the ground. Either passive irritation of the leg or turning the animal in a circle causes pain as in diseases of the joints. Sometimes the horse likes to get the heels on a stone or some elevation to relieve the weight from the flexor tendons. Finally, in cases of long standing, a shortening of the tendons occurs, resulting in the abnormal flexion of the foot known by horsemen as "broken down," or a more upright position of the foot may follow, producing perhaps knuckling or the so-called clubfoot.

Prognosis.—Generally, a leg that has received such injuries seldom returns to a perfect condition of efficiency and soundness. A certain amount of thickening and deformity will be permanent, even when the lameness has entirely disappeared.

Treatment.—The injured foot should receive the earliest attention possible, not only when the inflammatory condition is present, but also when it is subsiding and there is only the thickening of the ligaments, tendons, or sheath.

The most important remedy is rest, and the shoes should always be removed. During the first 3 days cold in the form of immersion or continuous irrigation is recommended. Then warm moisture and continuous pressure are advised. The latter is best applied by placing two padded splints about the thickness of the thumb along the two sides of the tendon and binding them in place with even pressure by bandage. Frequent bathing with warm soap suds is also beneficial. The absorption of the exudate may be promoted and the work of restoration effected by frictions with alcohol, mild liniments, strong, sweating liniments, and blistering agents. The action of blistering agents in these cases depends chiefly on the massage used in applying them and on the continuous pressure of the swollen skin on the inflamed tendons. In old cases more beneficial results will follow line

firing. In these cases shoeing is important. Leave the quarters long, shorten the toe, give the shoe rolling motion, and either put short heel calks on the branches or thicken the branches. Although this line of treatment is efficacious in many cases there are others in which the thickening of the tendons refuses to yield and the changed tissues remain firmly organized, leaving them in the form of a thick mass resting on the back part of the cannon bone.

KNUCKLING OF FETLOCK

As a consequence of the last-mentioned lesion of the tendons, a new condition presents itself in the articular disposition, constituting the deformity known as the knuckling fetlock. (See p. 374.) By this is meant a deformity of the fetlock joint by which the natural angle is changed from that of the healthy articulation. The first pastern or suffraginis, loses its oblique direction and assumes another, which varies from the upright to the oblique, from before backward, and from above downward; in other words, forming an angle with its apex in front.

Causes.—This condition may be the result of chronic disease producing structural changes in the tendons, and it may also result from other affections or some peculiarity independent of this and situated below the fetlock, such as ringbones, sidebones, or traumatic disease of the foot proper. Animals are sometimes predisposed to knuckling, such, for example, as are naturally straight in their pasterns, or animals that are compelled to labor when too young. The hind legs are more predisposed than the forelegs to this deformity, in consequence of the greater amount of labor they are required to perform as the propelling levers of the body.

Symptoms.—The symptoms of knuckling are easily recognized. The changes in the direction of the bones vary more or less with the degree of the lesion, sometimes assuming such a direction that it almost becomes a true dislocation of the pastern.

The effect of knuckling on the gait also varies according to the degree of the deformity. As the different degrees of the shortening of the leg affect the motion of the fetlock, the lameness may be slight or extreme. Another consequence of this shortening is such a change in the position of the foot that the heels cease to come in contact with the ground and assume a greater elevation, and the final result of this is soon witnessed in the development of a clubfoot.

Treatment.—To whatever cause the knuckling may be ascribed, it is always a severe infirmity, and there is little hope of overcoming it unless it be during the first stages of the trouble, and the hope is still less when it is secondary to other diseases below the fetlock. If it is caused by overworking the animal, the first step to be taken is rest. Line firing has proved to be very effective in these cases. The animal

must be turned loose and left unemployed. Careful attention should be given to the condition of the feet and to the manner of shoeing, while time is allowed for the tendons to become restored to their normal state and the irritation caused by excessive stretching has subsided. A shoe with a thick heel will contribute to this. If no improvement can be obtained, however, and the tendons though retracted have yet been relieved of much of their thickening, the case is not a desperate one, and may yet be benefited by the operation of tenotomy, single or double—an operation that must be performed by a competent veterinarian.

SPRUNG KNEES

This deformed condition consists in such an alteration in the direction and articulation of the bones which form the various carpal joints that instead of forming a vertical line from the lower end of the forearm to the cannon bone they are so united that the knee is more or less bent forward, presenting a condition caused by the retraction of two of the principal muscles by which the cannon bone is flexed.

Cause.—This flexion of the knee may be a congenital deformity that has continued since birth; or, like clubfoot, it may be the result of heavy labor that the animal has been compelled to perform when too young. It may also be due to other diseases existing in parts below the knee joint.

Symptoms.—This change of direction largely influences the movement of the animal by detracting from its firmness and practically weakening the entire frame, even to the extent of making the animal unsteady on its feet and likely to fall. This weakness is sometimes so pronounced that the animal is likely to fall even when standing at rest and unmolested, the knees being unable even to bear their portion of the weight of the body. This results in another trouble—that of being unable to keep permanently upright. The horse is likely to fall on its knees and by this act becomes presently a sufferer from the lesion known by the term of “broken knees.” Whatever may be the cause of this condition, it detracts greatly from the usefulness and value of a horse, disqualifying it for ordinary labor and wholly unfitting it for service under the saddle without jeopardizing the safety of the rider.

Treatment.—If the trouble is known from the beginning and is not the result of congenital deformity or weakness of the knee joint, or secondary to other diseases, rest, with fortifying frictions, may sometimes aid in strengthening the joints; and the application of blistering agents on the posterior part of the knee, from a short distance above to a point a little below the joint, may be followed by some satisfactory results; but with this trouble, as with knuckling fetlocks, the danger of relapse must be kept in mind as a contingency always likely to occur.

CURB

This lesion is the bulging backward of the posterior part of the hock, where in the normal state there should be a straight line, extending from the upper end of the point of the hock down to the fetlock.

Cause.—The cause may be a sprain of the tendon that passes on the posterior part of the hock, or of one of its sheaths, or of the strong ligament situated on the posterior border of the os calcis.

Hocks of a certain conformation seem to have a greater likelihood to curb than others. They are overbent, coarse, and thick, or may be too narrow from front to back across the lower portion. This condition may therefore result as a sequence to congenital malformation, as in horses that are "saber-legged." It often occurs, also, as the result of violent efforts, heavy pulling, high jumping, slipping or any of the causes heretofore considered as instrumental in producing lacerations of muscular, tendinous, or ligamentous structure.

Symptoms.—A hock affected with curb will present at the outset a swelling more or less diffuse on its posterior portion, with varying degrees of heat and soreness, and these will be accompanied with lameness of a permanent character. At a later period, however, the swelling will become better defined, the deformity more characteristic, the prominent, curved line readily detected, and the thickness of the infiltrated tissue easily determined by the fingers. At this time, also, there may be lameness, varying in degree, whereas at other times, the irregularity of action at the hock will be so slight as to escape detection.

A curb constitutes an unsoundness, since the hock thus affected is less able to endure severe labor and is more likely to give way with the slightest effort. Yet the prognosis of a curb cannot be considered serious, as it generally yields to treatment, or at least the lameness it may occasion is generally easily relieved, though the loss of contour caused by the bulging will always constitute a blemish.

Treatment.—On the first appearance of a curb, when it shows signs of an acute inflammation, the first procedure is to subdue it by the use of cold applications, as intermittent or constant irrigation or an ice poultice; when these have exhausted their effect and the swelling has assumed better defined boundaries, and the infiltration of the tendons or of the ligaments is all that remains of a morbid state, every effort must be directed to effecting its absorption and reducing its dimensions by pressure and other methods. The medicaments usually used are blistering agents. The use of the firing iron must, however, be frequently resorted to, either to remove the lameness or to stimulate the absorption. Its early application should be resorted to in preference to waiting until the exudation is firmly organized. Firing in dull points or in lines will prove as beneficial in curb as in any other disease of a similar nature.

LACERATED TENDONS

This form of injury, whether of a simple or of a compound character, may become a lesion of a serious nature and will usually require long and careful treatment, which even then may be unavailing in consequence either of the intrinsically fatal character of the wound itself or the complications that have rendered it incurable.

Cause.—Like all similar injuries, lacerated tendons are the result of traumatic violence, such as contact with objects, either blunt or sharp, such as a stone, tree stump, or fence, especially one of wire. They may easily occur in a runaway horse when its legs are struck with fragments of harness or splintered shafts, or by contact with the wagon that the animal has overturned and shattered with its heels while disengaging itself from the wreck.

Symptoms.—It is not always necessary that the skin be involved in this form of injury. On the contrary, the outer skin is frequently left entirely intact, especially when the injury follows infectious diseases or occurs during light exercise after long periods of rest in the stable. Again, the skin may be cut through and the tendons nearly severed. A point a little above the fetlock is usually the seat of the injury. But irrespective of this, and whether the skin is or is not implicated, the symptoms resemble those of a fracture. There is excessive mobility, at least more than in a normal state, with more or less inability to carry weight. There may be swelling of the parts, and on passing the hands carefully along the tendon to the point of division the stumps of the divided structure will be felt more or less separated, perhaps wholly divided. The position of the animal while at rest and standing is peculiar and characteristic. While the heels are well placed on the ground, the toe is correspondingly elevated, with a tendency to turn up—a form of breaking down that was described in the discussion on the fracture of the sesamoids. The weight is carried only with considerable difficulty but with comparatively little pain, and the animal will unconsciously continue to move the leg as if in great pain, notwithstanding the fact that the general condition may be very good.

The effects on the general organism of compound lacerated wounds of tendinous structures, or those associated with injuries of the skin, are different. The wound becomes in a short time the seat of a high degree of inflammation, with abundant suppuration filling it from the bottom; the tendon, whether as the result of the bruise or of the laceration, or of maceration in the accumulated pus, undergoes a process of softening, and necrosis and sloughing ensue. This complicates the case and probably some form of tendinous synovitis follows, running into suppurative arthritis, to end, if close to a joint, with a fatal result.

Prognosis.—The prognosis of lacerated tendons should be very conservative. Under the most favorable circumstances a period of 6 weeks to 2 months will be necessary for the treatment, before the formation of the cicatricial callus and the establishment of a firm union between the tendinous stumps.

Treatment.—As with fractures, and even in a greater degree, the necessity is imperative in the treatment of lacerated tendons to obtain as perfect a state of immobility as possible. The natural opposition of the animal, sometimes ill-tempered and fractious at best, at times causes much difficulty in applying the necessary treatment. Without the immobility there can be no close connection of the ends of the tendons. To fulfill this necessary condition, the posterior part of the foot and the fetlock must be supported and the traction performed by them relieved, an object that can be obtained by the use of the high-heeled and bar shoe, or possibly better accomplished with a shoe of the same kind extending about 2 or 2½ inches back of the heels. The perfect immobility of the legs is obtained in the same way as in the treatment of fracture with splints, bandages, iron apparatus, plaster of adhesive mixtures, and similar means. As long as the dressings remain in place undisturbed and no chafing or other evidence of pain is present, the dressings may be continued without changing, the patient being kept in slings for a period sufficient to insure the perfect union of the tendons. For a compound lesion when there is laceration of the skin some special care is necessary. The wound must be carefully watched and the dressings removed at intervals of a few days or as often as may be necessary, all of which additional manipulation and extra nursing, however indispensable, add to the gravity of the case and render the prognosis more and more serious. When the tendons have sloughed in threads of various dimensions, or if in the absence of this process of mortification healthy granulations should form and fill up the wound, still careful attention will be required, the granulating ends of the tendons having a tendency to bulge between the edges of the skin and to assume large dimensions, forming bulky excrescences or growths of a warty or cauliflower appearance, the removal of which becomes a troublesome matter.

The union of the tendons will at times leave a thickening of varying degree near the point of cicatrization, the absorption of which becomes difficult and doubtful, but which may be promoted by moderate blistering and the use of alterative and absorbent mixtures or perhaps the firing iron. A shoe with heels somewhat higher than usual will aid in moderating and relieving the tension of the tendons.

RUPTURE OF THE FLEXOR METATARSI

This is a muscle of the anterior part of the shank. It is situated in front of the tibia and is of peculiar formation, being composed of

a muscular portion with a powerful tendon, which is at first distinct and separate and united lower down, terminating at the lower end by a division into four tendinous bands. It is a powerful muscle of the hinder shank bone and also acts as a strong means of support for the stifle joint, that is, of the articulation of the thigh and shank bone, in front and outside of which it passes. Its situation and its use cause it to be liable to severe stretching and straining, and a rupture of some of its fibers is sometimes the consequence.

Cause.—This injury may be the result of a violent effort of the animal in leaping over a high obstacle, in missing its foothold and suddenly slipping backward, while powerfully grasping the ground with the feet in striving to start a heavily loaded vehicle, in making a violent effort to prevent a probable fall, or in attempting to lift the feet from miry ground.

Symptoms.—The accident is immediately followed by disability that varies according to the seat of the injury and the period of its duration. This rupture will not prevent the horse from standing perfectly and firmly on its feet when kept at rest, and while no muscular efforts are required there is no appearance of any lesion or unsoundness. An attempt to move the animal backward, however, will cause it to throw all the weight on its hindquarters, and it will refuse to raise the foot from the ground. If the animal is compelled to do so, the hock being no longer capable of flexion, the muscle that effects that movement being the injured one, the opposite muscles, the extensors, acting freely, the entire lower part of the leg, from the hock down, will be suddenly, with a jerk, extended on the tibia or shank bone, and simultaneously with this the tendon of Achilles, the cord of the hock, the tendons of the extensors of the hock will be put in a wrinkled and relaxed condition. The leg is behind the animal and the toe rests on the ground. Examination of the fore part of the shank from the stifle down to the hock may reveal soreness and possibly some swelling and heat at the seat of the lesion.

Treatment.—Generally speaking, these injuries are amenable to treatment. Provided a sufficient time is allowed for union to take place, recovery is obtained in most cases. The more flexed the leg can be kept, the quicker it will heal.

In these cases, as in those of simple laceration of tendons, already considered, the treatment to be used resembles that for fractures, coaptation of the lacerated ends and immobility being the necessary conditions to obtain. The first is difficult to accomplish by bandaging alone, and some authorities have recommended instead the application of blistering agents to accomplish this end.

To obtain immobility, the animal should be placed in slings snugly applied, and kept in a narrow stall. It should also be tied short and restrained from any backward movement by ropes or boards, and

should, moreover, be kept in as quiet a temper as possible by the exclusion of all causes of irritation or excitement. Weeks must then elapse, not less but frequently more than 6, often 8, before the animal can be considered out of danger and able to return to labor, which should for a time be light and easy, and gradually increased. However, the animal may never be able to do as heavy work as formerly. If it is used too soon the newly formed tissue between the ends of the muscle will be likely to stretch and leave the flexor muscle too long and permanently displaced.

ADDITIONAL AFFECTIONS OF THE EXTREMITIES

In some parts of the legs are certain peculiar little structures of a saclike formation, containing an oily substance for the lubrication of the parts on which they are placed for the purpose of facilitating the movements of the tendons that pass over them. These little sacs or muco-synovial capsules, under peculiar conditions of traumatism, are likely to become subject to a diseased process, consisting principally in a hypersecretion of their contents and an increase in dimensions, and they may undergo peculiar pathological changes of such character as to disable an animal, and in many instances to cause serious blemishes that depreciate its value. These growths, which are known as hygromata, may result from external violence, as blows or bruises, and may appear in the form of small, soft tumors, painless and not inflammatory in character, but, by a repetition of the cause or renewal of violence, likely to acquire increased severity. Severe inflammation, with suppuration, may follow, which, filling up the cavity, the walls will become thickened and hard, resulting in the formation of a tumor.

The elbow, knee, and hock are the parts of the body where these lesions are ordinarily found, and on account of their peculiar shape and the position they occupy they have been called "capped."

CAPPED ELBOW

Capped below, or "shoe boil," is a term applied to an enlargement often found at the point of the elbow.

Cause.—This lesion is due to injury or pressure of the part while it is resting on the ground. The horse, unlike the cow, does not rest directly on the undersurface of the sternum, or breastbone, on account of its sharp, ridgelike formation. It rests more on the side of the breastbone and chest, and consequently the leg that is flexed under the body is subject to considerable pressure. If the leg is flexed under the body so that the hoof or shoe is directly in contact with the elbow, which may occur in horses having an extremely long cannon bone or excessive length in the shoes, the greater part of the weight of the chest is concentrated at this point and the pressure may cause a bruise or an inflammation.

Symptoms.—Under these conditions the point of the elbow may become swollen and tender and exhibit heat and pain. This swelling may not only cover the point of the elbow but also reach the axilla and assume such proportions that there is great difficulty in using the leg, the animal showing signs of lameness even to the extent of the circumflex step, as in shoulder lameness. This edematous condition, however, does not remain stationary. It may by degrees subside or perhaps disappear. In the first instance it will become more distinctly defined, with better marked boundaries, until it is reduced to a soft, round, fluctuating tumor, with or without heat or pain. There is then either a bloody or serous tumor or a purulent collection, and following the puncture of its walls with the knife there will be an escape of blood, serum, or pus, as the case may be, in variable quantities. In either case, but principally in that of the cystic form, the tumor will be found to be subdivided by septa, or bands, running in various directions.

Various changes will follow the opening of the tumor and the escape of its contents. In most cases the process of cicatrization will take place, and the cavity fill up by granulation, the discharge, at first abundant, gradually diminishing and the wound closing, usually without leaving any mark. At times, however, especially if the disease has several times repeated its course, there may remain a pendulous sac, partly obliterated, which a sufficient amount of excitement or irritation may soon restore to its previous dimensions and condition.

In other cases an entirely different process takes place. The walls of the cavity, cyst, or abscess become ulcerated and thickened, the granulations of the sac become fibrous in their structure and fill up the cavity, and it assumes the character of a hard tumor on the back of the elbow, sometimes partly and sometimes entirely covered by the skin. It is fibrous, painless to the touch, well defined in its contour, and may vary in size from that of a small apple to that of a child's head.

This last form of capped elbow is the most serious of any, resisting all known forms of mild treatment, and removable by the knife only. The other forms, even that with the inflammatory aspect and its large edematous swelling that interferes with the work of the animal, may justify a much milder prognosis, and, aside from their likelihood to recur, may be ranked with the comparatively harmless affections.

Treatment.—As long as the danger of recurrence is the principal bad feature of capped elbow, the most important consideration is that of devising a means for its prevention. To prevent the animal from lying down is evidently the simplest method of keeping the heels and the elbow apart; but the impracticability of this is apparent, since most animals lie down when they sleep, though a few sleep while standing. The shortening of the inside branch of the shoe, which is the one with which the pressure is made, may be of advantage, especially if the truncated end of the shoe is smooth and filed over to remove

all possibility of pressure and contusion on the skin. The protection of the skin of the elbow by interposing soft tissues between that and the shoe, or by bandaging the heel with bags or covering it with boots, is considered by many the best of the preventive methods, and the advantage to be obtained by resorting to it cannot be overlooked when the number of horses that develop shoe boil whenever the use of the boot is intermitted is considered. In order to prevent the animal from assuming the sternal decubitus, many give preference to the plan of fastening a piece of wood across the stall at some distance from the front wall or manger. It is a simple expedient, primitive, perhaps, but nevertheless practical, and followed by good results.

The therapeutic treatment is also important. The edematous swelling, when recognized by its external appearance and the existing inflammation, should be treated without delay. Warm fomentations, repeated several times daily, are then recommended, the degree of warmth being as high as can be borne comfortably. They are easily applied and often yield decided relief in a few hours. In some cases, however, astringents in the form of poultices or pastes are used in preference. These are made to cover the entire swelling and allowed to remain. They dry after a short time, and perhaps fall off but are easily renewed. An excellent astringent for these cases is a putty made of powdered chalk and vinegar (calcium acetate), and the whole swelling is then covered with a thick coating of soft clay made into a mass with water.

These simple remedies are often all that is required. Under their use the swelling passes off by degrees and after a short interval the animal is fit for work again, but commonly a swelling develops, puffy, not painful, and perhaps giving a sensation of crepitation when pressure is applied with the finger. It is soft, evidently contains a liquid, and when freely opened with a good-sized incision discharges a quantity of blood, partly liquid and partly coagulated, and perhaps a little hemorrhage will follow. The cavity should then be well washed out and a plug of oakum introduced, leaving a small portion protruding through the cut to prevent it from closing prematurely. It may be taken off the next day, and a daily cleansing will then be all that is necessary. In another case the tumor becomes very soft in its whole extent, with evident fluctuation and a well-defined form. The discharge of the fluid is then indicated, and a free incision will be followed by the escape of a quantity of thin yellowish liquid from a single sac. The wound should be kept clean and dressed frequently, in order to insure prompt healing. But if the cavity is found to be subdivided in its interior by numerous bands and the cyst proves to be multilocular, the partitions should be torn out with the fingers and the cavity then treated in the same manner as the unilocular sac. In still another case the swelling may be warm and painful with indistinct fluctuation,

or fluctuation only at a certain point. This indicates an abscess and necessitates an incision to drain the pus, followed by the careful cleansing and dressing of the wound.

But cases occur in which all the treatment that has been described fails to effect a full recovery, and instead a fibrous tumor begins to develop. A change of treatment is then in order. The inflammation, being chronic, will necessitate stimulating treatment of the part in order to increase the process of absorption. Blistering agents, fomentations, iodine, and mercurial ointments should then be used. Good results are more likely to be obtained if these remedies are used at an early stage and applied properly. Small quantities should be carefully and perseveringly rubbed in daily. The rubbing should be done gently, not with force, nor with the expectation of producing an astonishing effect by heavy applications and main strength in a few hours. The object is to induce the drugs to permeate the affected part until the entire mass is penetrated. Cases will be encountered that resist all form of medicinal treatment. The tumor continues to grow; it is large and pendulous at the elbow; its weight is estimated in pounds; it is not an eyesore merely but an uncomfortable, burdensome mass, excoriating all the surrounding parts and being itself excoriated in turn; mild treatment has failed and is no longer to be relied on. Resort must now be had to surgical methods; the choice must be between the ligature, cautery, and knife. Each has its advocates among practitioners. Because of the conformation and size of the animal, a difficulty arises in connection with the application and retention of bandages and other dressings after the amputation has been performed. There is need for considerable practical ingenuity to adjust and retain the appliances necessary to insure a good final result.

CAPPED KNEE

The passage of the tendons of the extensor muscle of the cannon, as it glides in front of the knee joint, is assisted by one of the little bursae before mentioned, and when this becomes the seat of dropsical collection a hygroma is formed and the knee is capped. Though in its history somewhat analogous to the capped elbow, there are points of difference between them.

Cause.—The capped knee is sometimes the result of a bruise, often repeated, self-inflicted by a horse that has the habit of pawing while in the stable and striking the front of the stall with its knees. Sometimes it is formed in weak-kneed animals that are subject to falling and bruising the front of the joint against the ground, the results not always being of the same character.

Symptoms.—The lesion may be a simple bruise, or it may be a severe contusion with swelling, edema, heat, and pain. The joint

becomes so stiff and rigid that it interferes with locomotion and yet under careful, simple treatment the trouble may disappear.

Again, instead of altogether passing off, the edema may diminish in extent, becoming more defined in form and may remain as a swelling on the front part of the knee. Resulting from the crushing of small blood vessels, this is necessarily full of blood. The swelling is somewhat soft, diffuse, not painful, more or less fluctuating, and after a few days becomes crepitant under the pressure of the hand.

Instead of being filled with blood the swelling may be full of serum, as often occurs when violence, though perhaps slight, has been frequently repeated. In that case the swelling is generally well defined, soft, and painless, with more or less fluctuation, and it may even become pendulous. In other cases the swelling may be acute and inflammatory with heat and pain, accompanied with stiffness of the joint. This leads to the formation of an abscess. Whatever the nature of these swellings may be, either full of blood, serum, or pus, some blemish usually remains after treatment.

Prognosis.—Though simple bruises of the knee without extensive lesions are usually of trifling account, a different prognosis must be pronounced when the lesion becomes larger, and though a capped knee may be of comparatively little importance it sometimes results not only in extensive blemishes to disfigure the patient, but the animal becomes worthless in consequence of the extension of the diseased process to the various elements composing the joint.

Treatment.—Usually the first symptom of trouble is the edematous swelling on the front of the knee. The prevention of the inflammation and consequently of the abscess is the prime object in view, and it may be realized by the use of warm-water fomentations or compresses applied over the swelling, which may be used either in a simple form or combined with astringents, such as Goulard's extract, alum, or zinc sulfate. The application of warm poultices of ground flaxseed, enveloping the whole joint and kept in place by bandages, is often followed by absorption of the swelling, or, if the abscess is in process of formation, by the active excretion of pus. If an abscess forms in spite of these precautions it may be treated surgically in several ways.

Sometimes this can be done by a careful incision, which will allow the escape of the blood or the serum, or of the pus enclosed in the sac; at another time it is necessary to adopt the more cautious manner of emptying the cavity by means of punctures with small trocars or aspirators. The danger attending this last method arises from the possible sloughing of large portions of the skin, whereas that attending the first is the possibility of the extension of the inflammation to the capsular ligament of the knee, with the possibility of an open joint.

As already stated, the cavity after being emptied may rapidly close and leave in a short time but slight traces of its previous existence. But in many cases, there will remain, after the cicatrization is complete, a thickening or organized exudation at one time round and well defined, at another spreading by a diffused infiltration, to which it will be necessary to give immediate attention, from the fact of its tendency to form into an organized and permanent body. To stimulate inflammation in this diseased structure, blistering agents are recommended, but chiefly for the purpose of promoting the process of absorption.

If this treatment fails, the use of iodine and mercurial preparations is recommended.

Plain mercurial or plain iodine ointment, or both in combination as iodide of mercury, is commonly used and may be applied either moderately and gently as previously suggested, or more freely and vigorously with a view to more immediate effects, which, however, will also be more superficial. The use of the firing iron applied deeply with fine points is then to be strongly recommended, to be followed by blistering agents and various liniments. This course usually gives satisfactory results.

While the treatment is in progress, it will be necessary to secure the animal in such manner that a recurrence of the injury will be impossible from causes similar to those that were previously responsible.

CAPPED HOCK

A bad habit of rubbing or striking the partitions of their stalls with their hocks prevails among some horses, resulting in an injury that shows itself on the upper points of those bones, the summit of the os calcis. From its analogy to the condition of capped elbow, the designation of capped hock has been applied to this condition.

Symptoms.—A capped hock is the development of a bruise at the point of the hock, which if many times repeated may excite an inflammatory process, with all its usual external symptoms of swelling, heat, and soreness.

The swelling is at first diffused, extending more or less on the exterior part of the hock, and in a few instances running up along the tendons and muscles of the back of the shank. Soon, however, unless the irritating causes are continued and repeated, the edema diminishes, and, becoming more defined in its external outlines, leaves the hock capped with a hygroma. The hygroma, at the beginning of the trouble, contains a bloody serum that soon becomes strictly serum, and this, through the influence of an acute inflammatory action, is likely to undergo a change that converts it into the usual purulent product of suppuration.

The external appearance ought to be sufficient to determine the diagnosis, but there are a few signs that may contribute to a more exact identification of the lesion. The capped hock, whether appearing as an acute, edematous swelling, as a bloody serous collection, or as a simple serous cyst, does not give rise to any remarkable local manifestation other than those mentioned under similar injuries. Nor will it be likely to interfere with the functions that belong to the member in question, unless it assumes large dimensions and on each side of the tendons, as well as on the summit of the bone. But if the inflammation is high, if suppuration is developing, if there is a true abscess, or—and this is a common complication especially when the kicking or rubbing of the animal is frequently recurring—besides the local trouble of the cyst or of the abscess, the bones become diseased and the periosteum inflamed, the superior ends of the bone and its fibrocartilage may become affected, and a simple lesion or bruise, becomes complicated with periostitis and ostitis and is naturally accompanied with lameness, developed in a greater or less degree, which in some cases may be permanent and in others increased by work. These complications, however, are not common or frequent.

Prevention and treatment.—Capped hocks are in many cases amenable to treatment. Yet they often remain an eyesore on the top of the hock. They do not interfere with the work of the horse but give it the reputation, whether justifiable or not, of being an habitual kicker and, worse than all, one that kicks when fed.

The maxim that “an ounce of prevention is worth a pound of cure” applies particularly to the present case. A horse whose hocks have a somewhat puffy look and whose skin on the front of the hock is loose and flabby is especially subject to suspicion of having acquired the bad habit mentioned. A little watching will soon establish the truth. If the verdict is one of conviction, precautions should be immediately adopted against a continuance of the evil. The sides of the stall should be padded with straw mats or mattresses and the posts covered with similar material, in such manner as to expose no hard surface with which to come in contact. The animal may jar its frame when it kicks, but even then there will be less force in the concussion than if it struck the solid plank, and cuts and abrasions cannot be inflicted by a properly made cushion. Hobbles are also recommended with a view to the required restraint of motion, so applied as to secure the leg with which the kicking is performed, or even both hind legs, in such manner as not to interfere with the movement of lying down and rising again and yet preventing that of kicking backward. Boots similar in pattern to those used for the prevention of shoe boil are also prescribed. These are placed above the hock and retained by straps tightly fastened. However, the difficulty of retaining them in the

proper place without the danger of chafing from the tightness of the straps may be an objection to their use.

The mode of treating capped hocks will be greatly influenced by the condition of the parts. When the inflammation is excessive and the swelling large, hot, and painful to the touch, the application of warm water will be painful. The leg should be well fomented several times a day, for 15 to 20 minutes each time, a strong decoction of marsh-mallow leaves being added to the water, and after each application swathed with flannel bandages soaked in the same warm mixture. A few days of this treatment will usually effect a reduction of the inflammation; if not complete, at least sufficiently so to disclose the correct outlines of the hygroma and exhibit its peculiar and specific symptoms. The expediency of its removal and the method of accomplishing it are then to be considered, with the question of opening it to give exit to its contents. If the fluid is of a purulent character, the indication is in favor of its immediate discharge. No time should be lost, and it should be by means of a small opening made with a narrow bistoury. If, however, the fluid is serous, it is better to remove it by punctures with a very small trocar. This special caution is recommended in these cases because of the possibility of the existence of diseased conditions of a severe character in the pseudo joint. For the same reason these growths should be treated by external applications. In the first stages of the disease a severe and stiff blistering agent entirely covering the cyst, perhaps not yet completely formed, when the inflammation has subsided, will be of great benefit by its stimulating effect, the absorption it may excite, and the pressure which, when dry, it will maintain upon the tumor. If, however, the thickening of the growth fails to diminish, it may be treated with some of the iodine preparations in the form of ointments, pure or in combination with potassium, mercury, etc., of various strengths and in various proportions. Cautery, by deep and fine firing, in points—needle cauterization—is considered the best mode of treatment, especially when applied early.

A satisfactory way to treat these cases is to burst the swelling by pressure from without. A strap or strong linen bandage is placed about the hock, pressing on the bursa, while the affected leg is on the ground, the other hind foot being lifted up. When the bandage is in place the leg should be released, and the horse will violently flex the bandaged limb and produce pressure on the bursa, with consequent bursting and discharging of its contents.

Regardless of the treatment adopted for capped hock, the healing process will be slow and require much patience. In these parts absorption is slow, the skin is very thick, and its return to a soft, pliable, natural condition, if effected at all, will take place only after weeks added to other weeks of medicinal treatment.

INTERFERING AND SPEEDY CUTS

These designations belong to certain special injuries of the extremities, produced by similar causes. They give rise to similar pathological alterations, require about the same treatment, and are often followed by the same results—a blemish that may not only subject the animal to a suspicion of unsoundness, but also in some special circumstances may interfere with its ability to work.

These injuries are always the result of a blow, self-inflicted, of varying severity, and giving rise to various lesions. (See p. 373.) The injury is known as interfering when the location of the trouble is the inside of the fetlock of either the fore or hind leg. It is called speedy cut when it occurs on the inside of the foreleg, a little below the knee, at the point of contact of that joint with the cannon.

Symptoms.—At times the injury is too slight to be seriously noticed, the hair being scarcely cut and the skin unmarked. At other times the skin will be cut through, partly or wholly, and it may for the time cause sufficient pain to check the motion of the animal through its inability to use the wounded leg. The horse then travels for a short space on three legs only. Sometimes a single blow will suffice, or again there will be a repetition of lighter strokes. In the latter case the parts will become much swollen, hot, and so painful to the touch that the motion of the knee or the fetlock will be sufficiently disturbed to cause lameness of a degree of severity corresponding to that of the lesion. Following the subsidence of this diffused and edematous swelling is sometimes the formation of a tumor, either at the knee or the fetlock. This may be soft at first or become so by degrees, with fluctuation, its contents being at first extravasated blood, and later a serosity; or, if there has been a sufficient degree of inflammation, it may become suppurative. The result of the fault of interfering may thus be exhibited, whether at the knee or at the fetlock, as characterized by all the pathological conditions that have appeared as accompaniments of capped knee or capped hock. If, in consequence of the force of the blow or blows, the inflammation has been unusually severe, a mortification of the skin may become one of the consequences, a slough taking place, succeeded by a cutaneous ulcer on the inside of the fetlock or where the greater number of the original wounds are inflicted. If the interfering has been often repeated it may be followed by a plastic exudation or thickening of the parts, which are commonly said to have become callous, and the effect of it is to destroy the regularity of the outlines of the joint to an extent that constitutes a serious blemish, which will be permanent.

An animal, in interfering, may thus exhibit a range of symptoms that from the simplest form of a mere touching may successively assume the serious characters of an ugly cicatrix, a hard, plastic

swelling, or perhaps, as witnessed at the knee, of periostitis with its sequelae.

If a single and constantly recurring cause—a blow—is the starting point in interfering, some predisposition in the animal will be found as a cause. The most frequent and important is peculiarity of conformation in the animals addicted to it. The first class will include horses whose chests are narrow and whose legs do not stand straight and upright but are crooked and pigeon-toed in and out. The second class includes those whose legs are weak, either from youth or hard labor, or from severe attacks of sickness. Another class is made up of those having abnormally developed feet, or those that have been badly shod with unnecessarily wide or heavy shoes. Another class consists of those that are affected with swollen fetlocks or chronic, edematous swelling of the leg. Another is formed of animals with a peculiar action, as those whose knee action is very high. The last-mentioned furnish most of the cases of speedy cut.

Prognosis.—The prognosis of interfering is never a very serious one. However violent the blow may be it is rare that subsequent complications of a troublesome nature occur. The principal evil attending it is a thickened or callous deposit that is not only a blemish, but also a new and increased predisposition. The remark that “an animal which has interfered once is always likely to interfere” is often confirmed and sanctioned by a recurrence of the trouble.

Treatment.—The treatment for this lesion is the same as for those of a similar nature, already considered. This consists of warm fomentations, soothing applications, and astringent and resolvent mixtures, in most cases. If the swelling assumes the character of a serous collection, pressure, cold water, and bandages will contribute to its removal. If suppuration seems to be established and the swelling assumes the character of a developing abscess, hot poultices and the rubbing with sedative ointments, such as basilicon or petrolatum usually give beneficial results. When an abscess has formed and is fluctuating, it should be carefully but fully opened to evacuate the pus. If it is a serous cyst, some care is necessary in emptying it, and the possibility of the extension of the inflammation to the joint must be taken into consideration. When the cavities have been emptied and have closed by filling up with granulations, or if, not being opened, the contents have been reabsorbed, and there remains in either case a plastic exudation and a tendency to a callous condition, the use of blistering agents is then recommended principally in the early stages, as it is then that their effects will prove most satisfactory. The use of the actual cautery, with fine points, penetrating deeply throughout the enlargement, in the very early stages of its formation, nearly always results in a radical recovery with complete absorption of the thickening.

STRINGHALT

This is an involuntary movement of one or both hind legs, in which the foot is suddenly and spasmodically lifted from the ground much higher than it is normally carried, with excessive flexion of one bone upon the other. This peculiarity is usually prominent, although it may disappear with work, only to reappear after a short rest. Sometimes it is most apparent at a trot, sometimes at a walk, and other times only when the animal is turned around, or it may not be affected by the gait of the horse. It does not seem to be influenced by the horse's age, young and old being alike affected. Its first manifestations are sometimes very slight. It has been noticed as occurring in an animal when backing out of the stable and ceasing immediately after. In some animals it is best seen when the animal is turning around on the affected leg, and it is not noticed when it moves straight forward. This peculiar action interferes with facility of locomotion and detracts from a horse's soundness.

Cause.—Veterinarians and pathologists are yet in doubt in respect to the cause of this affection, as well as to its essential nature. It is not known whether it results from disease of the hock, of an ulcerative character; whether it springs from a malformation; whether it is shortening of the ligaments, a chronic inflammation of the sciatic nerve, or a disease of the spinal cord; whether it is purely a muscular or purely a nervous lesion, or a compound of both.

Treatment.—When there is a known or suspected cause the treatment should be directed toward this factor. If due to local inflammation of the hock or foot, only this local lesion should be treated. If it remains after the local lesion has healed, or if there is no assignable cause, the best results have followed the sectioning of the lateral extensor of the foot. A competent veterinarian alone should undertake this operation.

THROMBOSIS

Under certain peculiar conditions of inflammation of the blood vessels, and also in aneurisms, clots of blood are sometimes formed in the arteries and find their way in the general circulation. At first, while very small, or sufficiently so to pass from one vessel to another, they move from a large vessel to a smaller, and from that to one still smaller, constantly increasing in size until at some given point, from their inability to enter smaller vessels, their movement is finally arrested. The artery is thus effectually dammed, and the clot in a short time cuts off completely the supply of blood from the parts beyond. This is thrombosis, and it often gives rise to sudden and excessive lameness of a very painful character.

Symptoms.—Thrombi may form in any of the arteries, and doubtless have been the cause of many cases of lameness that could never

be accounted for. If they exist in small arteries their diagnosis will probably fail to be made out with certainty, but when situated in the larger trunks there may be a strong suspicion of their presence. In some cases they may even be positively recognized as when the vessels that supply the posterior extremities are effected by the blocking up of the posterior aorta or its ramifications.

The existence of thrombosis of the arteries of the hind leg may always be suspected when the following history is known: The general health of the animal is good, but symptoms of lameness in one of the legs have developed, becoming more marked as the animal is worked, and especially when driven at a fast gait. But the disturbance is not permanent, and the lameness disappears almost immediately after a rest. There is an increase of the difficulty, however, and, though the animal may walk normally, it will, when made to trot, soon begin to slacken its pace and show signs of the trouble, and if urged to increase its speed will become lamer and lamer; an abundant perspiration will break out; the animal will refuse to move, and if forced shows weakness behind, seems ready to fall, and perhaps does fall. While standing, the leg is kept in constant motion, up and down, and is kept from the ground as if the contact were too painful to bear. If undisturbed this series of symptoms will gradually subside, sometimes very soon, and occasionally after a few hours the animal will return to an apparently perfect condition. A return to labor will lead to a renewal of the same incidents.

Such a history suggests a strong suspicion of a thrombus in an artery of the hind leg, and this suspicion will be confirmed by the external symptoms exhibited by the animal. The total absence of any other disease that might account for the lameness; a manifest diminution of heat over a part or the whole of the extremity, when compared with the opposite side or with any other portion of the body; a sensation of cold attendant on the pain, but gradually subsiding as the pain subsides, and the circulation after a rest, has been reestablished throughout the extremity—all these are confirmatory circumstances. Still, it is thus far only a suspicion, and absolute certainty is yet lacking. To establish the truth of the case the rectal exploration must be resorted to. The hands, well lubricated and carefully introduced into the rectum, must first feel for the large blood vessels that, divided at the aorta, separate to supply the right and left legs. These must be compared in respect to the pulsation and other particulars. The artery that is healthy will exhibit all the proper conditions of that state. On the other hand, if the vessel feels hard, more or less cordy, and pulseless, or gives a sensation of fluttering, as of a small volume of blood with a trickling motion passing through a confined space, the difference between the sides will make the case plain. The first will

be the full flow of the circulation through an unobstructed channel; the other, a forced passage of the fluid between the thrombus and the coats of the artery. In such case the prognosis is necessarily a grave one, and the disease is more likely to grow worse than better.

Treatment.—No form of treatment can be advised; in serious cases of the disease the animal should be killed to prevent further suffering.

Cases occur, however, in which this condition of the blood vessels exists in a much less degree and the diseased condition is not sufficiently pronounced to justify killing the animal at once. There may even be a possibility of the absorption of the clot, or that an increase of the collateral circulation may be sufficient to supply the parts with blood. In such cases spontaneous recovery may follow moderate exercise in the pasture, field, or stable, or continuous light work may be given, but too much hope should not be placed in such treatment.

SPRAINS OF THE LOINS

This is an affection that suggests muscular injury and is difficult to distinguish from many similar cases. If the animal shrinks from the slightest pressure or pinching of the spine in the region of the loins, it is often considered to be "lame in the loins," or "sprained in the loins," or "weak in the kidneys." This is a grave error, as in fact this simple and gentle yielding to such a pressure is not a pathological sign but is normal and significant of health. Yet there are several conditions to which the term "sprains of the loins" may apply that are not strictly normal.

Cause.—The muscles of the back and those of the loins proper, as the psoas, may have been injured, or there may be trouble of a rheumatic nature, perhaps suggestive of lumbago. Diseases of the bones of the vertebral column, or even those of the organs of circulation, may give rise to similar symptoms.

Symptoms.—The symptoms are characteristic of a loss of rigidity or firmness of the vertebral column, both when the animal is at rest and in action. When at rest, there is an arched condition of the back and a constrained posture in standing, with the hind legs separated. When the animal is in action, there is a lateral, balancing movement at the loins, principally noticeable while the animal is in the act of trotting—a peculiar motion, sometimes referred to as a "crick in the back." If, while in action, the animal is suddenly made to halt, the act is accompanied with much pain, the back suddenly arching or bending laterally, and perhaps the hind legs thrown under the body, as if unable to perform their functions in stopping, and sometimes it is only accomplished at the cost of a sudden and severe fall. This manifestation also occurs when the animal is forced to back, when a repetition of the same symptoms will also occur.

If a slight pressure on the back or the loins is followed by a moderate yielding of the animal, it is, as before remarked, a good sign of health. With a sprain of the loins pressure of any kind is painful and will cause the animal to bend or to crouch under it more or less, according to the weight of the pressure. Heavy loads, and even heavy harnessing, will develop this tenderness. In lying down the animal seems to suffer much discomfort and often accompanies the act with groaning, and when compelled to rise does so only with great difficulty and seldom succeeds without repeated efforts.

Sprains of muscles proper, when recent, will always be accompanied with this series of symptoms, and when these occur and there are an excessive sensibility of the parts, and possibly a degree of swelling, there is always justification for a diagnosis of acute muscular lesion, and especially so if accompanied with a history of violent efforts, powerful muscular strains, falls, or heavy loading. If the symptoms have been of slow development and gradual increase, it is a more difficult task to determine whether the diagnosis points to pathological changes in the structure of the muscles or of the bones, the nervous centers, or the blood vessels of the region. And yet it is important to decide which particular structure is affected as the degree of gravity of the lesion will depend largely on whether the disabled condition of the animal is due to an acute or a chronic disease.

Treatment.—The first and most important treatment is rest. An animal so affected should be immediately placed in slings. Hot compresses, cold-water douches, sweating applications, stimulating frictions, blistering ointments, and the actual cautery may be beneficial, but in no case can the immobility obtained by the slings be dispensed with.

Diseases of the Fetlock, Ankle, and Foot

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ANATOMY OF THE FOOT

The bones of the fetlock and foot constitute the base on which the other structures are built and comprise the lower end of the cannon bone (the metacarpus in the foreleg, the metatarsus in the hind leg), the two sesamoids, the large pastern or os suffraginis, the small pastern or coronet, the small sesamoid or navicular bone, and the coffin bone or os pedis (pl. XXXIV, fig. 3).

The cannon bone extends from the knee or hock to the fetlock, is cylindrical in shape, and stands nearly or quite perpendicular.

The sesamoids occur in pairs, are small, shaped like a three-faced pyramid, and are set behind the fetlock joint, at the upper end of the large pastern, with the base of the pyramid down.

The large pastern is a very compact bone, set in an oblique direction downward and forward, and extends from the cannon bone to the coronet.

The coronet is a short, cube-shaped bone, set between the large pastern and coffin bone, in the same oblique direction.

The navicular bone is short, flattened above and below, and is attached to the coffin bone behind.

The coffin bone forms the end of the foot and is shaped like the horny box in which it is enclosed.

All these bones are covered on the surfaces that go to make up the joints with a cartilage of incrustation, and the portions between are covered with a fibrous membrane called the periosteum.

The joints of the legs are of especial importance, since any interference with their function largely impairs the value of the animal for most purposes. As the joints of the foot and ankle are at the point of greatest concussion they are the ones most subject to injury and disease.

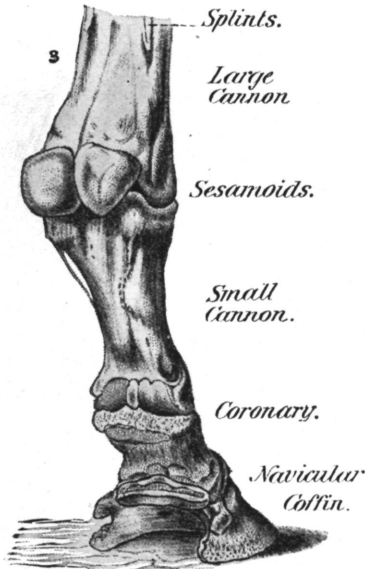
There are three of these joints—the fetlock, pastern, and coffin. They are made by the union of two or more bones, held together by ligaments of fibrous tissue, and are lubricated by a thick, viscid fluid, called synovia, which is secreted by a special membrane enclosing the joints.

1



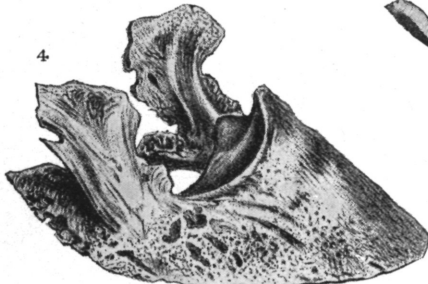
Ring Bone,
after Dodd.

3



Bones of the foot,
after Chaveau.

4



Side Bones,
after Stonehenge.

2

Fore arm.

Knee.

Splint bone

Cannon bone

Suspensory
ligament.

Fetlock.

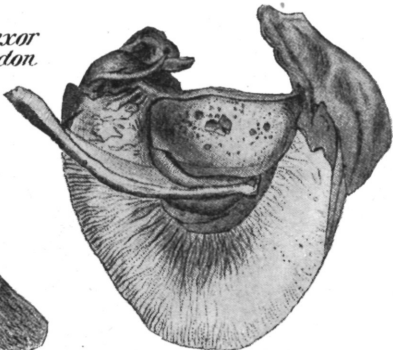
{ Flexor
perforans.

{ Flexor
perforatus.

Foot.

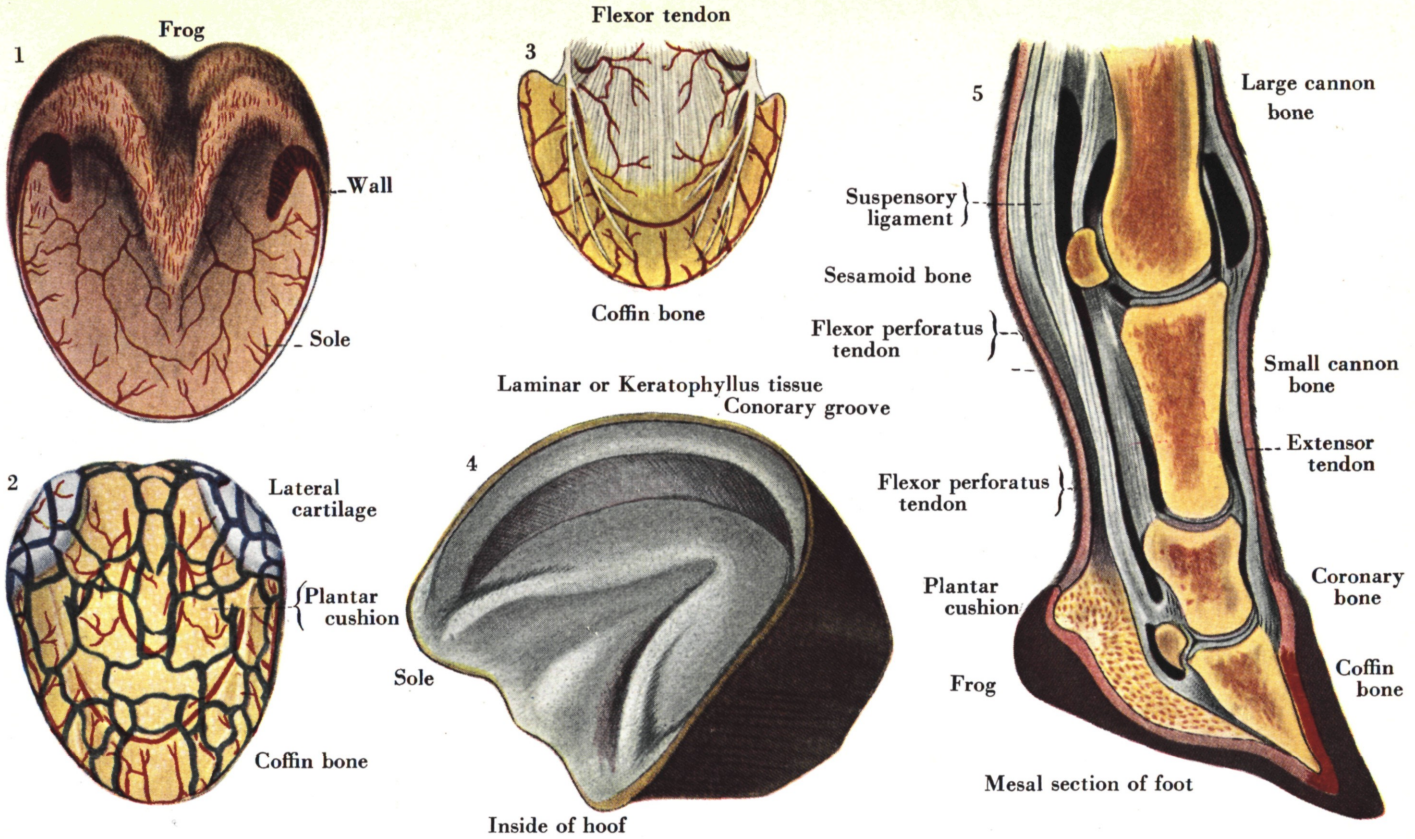
Anatomy of the foot,
after Haubner.

Flexor
tendon



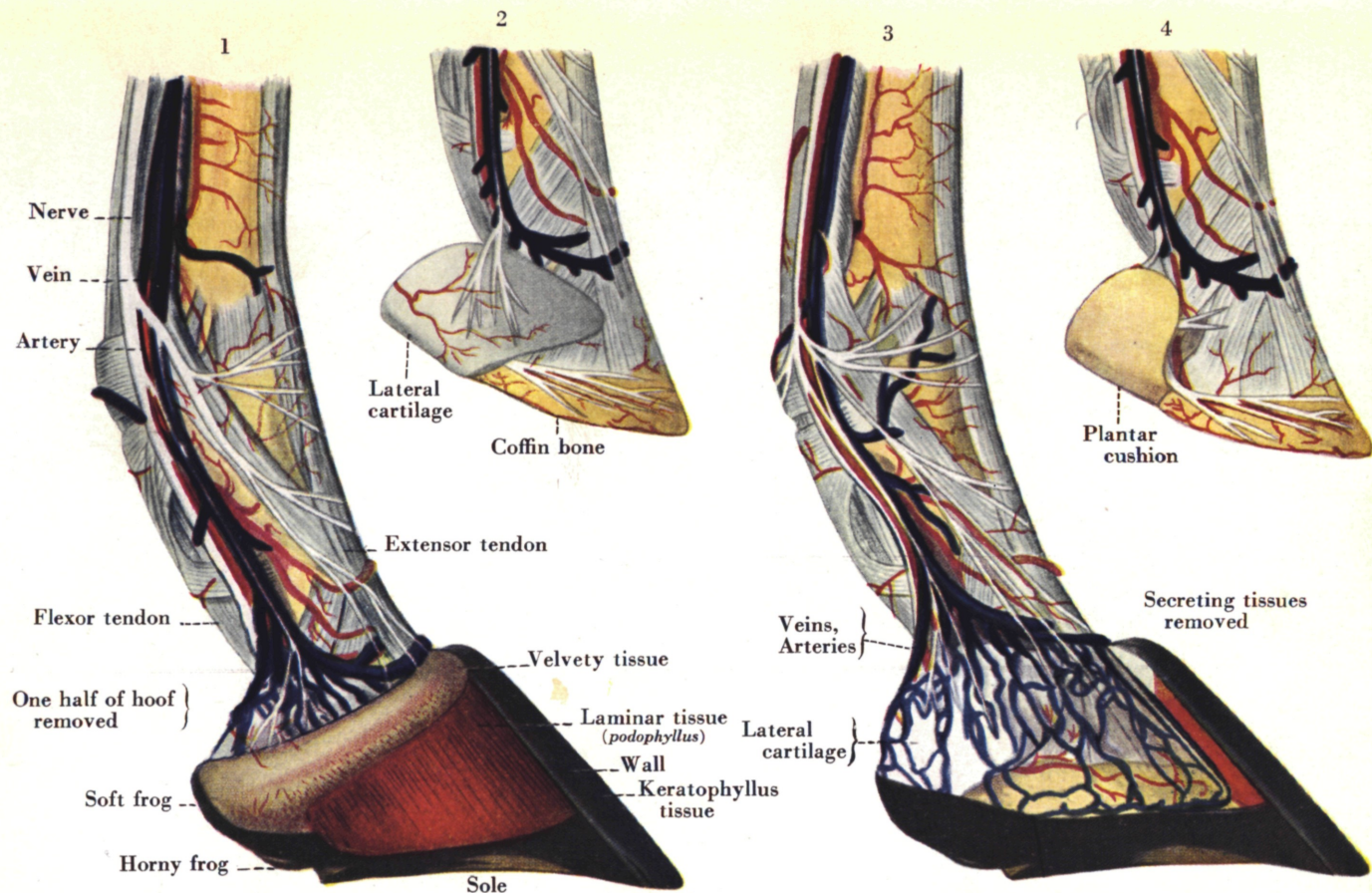
Navicular Disease,
after Stonehenge.

Haines, del.



Haines, del. Nos. 1, 2, and 3, from model. No. 4, from nature. No. 5, after Hering (colored).

ANATOMY OF FOOT.



Haines, del. from Auzoux model.

ANATOMY OF FOOT.

The fetlock joint is made by the union of the lower end of the cannon and the upper end of the large pastern bones, supplemented by the two sesamoids, so placed behind the upper end of the pastern that the joint is capable of extensive motion. These bones are held together by ligaments, only one of which—the suspensory—requires special mention.

The suspensory ligament of the fetlock begins at the knee, extends down behind the cannon, lying behind the two splint bones, until near the fetlock, where it divides and sends a branch on each side of the joint, downward and forward, to become attached on the sides of the extensor tendon at the lower end of the pastern bone. As it crosses the sesamoids, on the posterior borders of the fetlock, it throws out fibers that hold it fast to these bones (pl. XXXIV, fig. 2).

The pastern joint is made by the union of the two pastern bones.

The coffin joint is made by the union of the small pastern, coffin, and small sesamoid, or navicular bones, the latter being set behind and beneath the joint surface of the coffin bone in such a way as to receive largely the weight of the small pastern.

Three tendons move the bones of the foot one on another. Two of these flex, or bend, the joints, whereas the other extends, or straightens, the column of bones (pl. XXXIII, fig. 5).

The flexor pedis perforans, or deep flexor of the foot, passes down behind the cannon bone, lying against the suspensory ligament in front, crosses the fetlock joint in the groove made by the union of the two sesamoids, and is attached to the bottom on the coffin bone, after covering the navicular, by a wide expansion of its fibers. It is the function of this tendon to flex the coffin bone and, with it, the horny box.

The flexor pedis perforatus, or superficial flexor of the foot, follows the course of the preceding tendon and is attached to the middle of the ankle. The function of this tendon is to flex the foot at the fetlock.

The extensor pedis runs down in front of the leg, is attached on the most prominent point of the coffin bone, and has for its function the straightening of the bones of the ankle and foot.

The bones, ligaments, and tendons are covered by a loose connective tissue, which gives a symmetry to the parts by filling up and rounding off, and all are protected by the skin and hoof.

The skin of the fetlock and ankle is generally characterized by its thickness and the length of its hairs, especially around the hind parts of the fetlock joint in certain breeds of horses. The most important part of this envelope is known as the coronary band.

The coronary band is that portion of the skin which secretes the horn of which the wall of the hoof is made. This horn much resembles the nails that grow on the fingers and toes of man. It is com-

posed of cylindrical tubes, which are held together by a tenacious, opaque matter. The horn extends from the coronary band to the lower border of the hoof (pl. XXXII, fig. 1).

The hoof is a box of horn, consisting of a wall, sole, and frog, and contains, besides the coffin, navicular, and part of the small pastern bones, the sensitive laminae, plantar cushion, and the lateral cartilages. (pl. XXXIII, fig. 4).

The sole of the foot encloses the box on the ground surface, is shaped like the circumference of the foot, except that a V-shaped opening is left behind for the reception of the frog, and is concave on the lower surface. The sole is produced by the velvety tissue, a thin membrane covering the plantar cushion, and other soft tissues beneath the coffin bone. The horn of the sole differs from the horn of the wall in that its tubes are not straight and it scales off in pieces over the whole surface.

The frog is a triangular-shaped body, divided into two equal parts by a deep fissure, extending from its apex in front to the base. It fills the triangular space in the sole, to which it is intimately attached by its borders. The horn of the frog is produced in the same manner as the sole; but it differs from both the wall and sole in that the horn is soft, moist, and elastic to a remarkable degree. It is the function of the frog to destroy shock and to prevent slipping.

The sensitive laminae are thin plates of soft tissue covering the entire anterior surface of the coffin bone. They are present in great numbers, and by fitting into corresponding grooves on the inner surface of the horn of the wall the union of the soft and horny tissues is made complete (pl. XXXII, fig. 1).

The plantar cushion is a thick pad of fibrous tissue placed behind and under the navicular and coffin bones and resting on the sole and frog, for the purpose of receiving the downward pressure of the column of bones and to destroy shock (pl. XXXII, fig. 4).

The lateral cartilages are attached, one on each side, to the wings of the coffin bone by their inferior borders. They are thin plates of fibrocartilage, and their function is to assist the frog and adjacent structures to regain their proper position after having been displaced by the weight of the body while the foot rested on the ground (pl. XXXII, fig. 2).

FAULTS OF CONFORMATION

A large percentage of horses have feet that are not perfect in conformation, and as a consequence they are especially predisposed to certain injuries and diseases.

Flatfoot is that condition in which the sole has little or no convexity. It is a peculiarity common to some breeds, especially heavy, lymphatic animals raised on low, marshy soils. It is confined to the

forefeet, which are generally broad, low-heeled, and with a wall less upright than in the perfect foot. In flatfoot there can be little or no elasticity in the sole, for the reason that it has no arch, and the weight of the animal is received on the entire plantar surface, as it rests on the ground instead of on the wall. For these reasons such feet are particularly liable to bruises of the sole, corns, pumiced sole, and excessive suppuratation when the process is once established. Horses with flatfoot should be shod with a shoe having a wide web, pressing on the wall only, and the heels and frog are never to be pared. In flatfoot the walls are generally weak, and as a consequence the nails of the shoe are readily loosened and the shoe cast.

Clubfoot is a term applied to such feet as have the walls set nearly perpendicular. When this condition is present the heels are high, the fetlock joint is thrown forward, or knuckles, and the weight of the animal is received on the toes. Many mules are clubfooted, especially behind, where it seems to cause little or no inconvenience. Severe cases of clubfoot may be cured by cutting the tendons, but as a rule special shoeing is the only measure of relief that can be adopted. The toe should not be pared, but the heels are to be lowered as much as possible and a shoe put on with a long, projecting toe piece, slightly turned up, and the heels of the shoe are to be made thin.

Crookedfoot is that condition in which one side of the wall is higher than the other. If the inside wall is the higher, the ankle is thrown outward, so that the fetlock joints are abnormally wide apart and the toes close together. Animals with this deformity are pigeon-toed and are prone to interfere, the inside toe striking the opposite fetlock. If but one foot is affected, the liability to interfere is still greater, for the reason that the fetlock of the perfect leg is nearer the center plane. When the outside heel is the higher the ankle is thrown in and the toe turns out. Horses with such feet interfere with the heel. If but one foot is so affected, the liability to interfere is less than when both feet are affected, for the reason that the ankle of the perfect leg is not so near to the center plane. Such animals are especially liable to stumbling and to lameness from injury to the ligaments of the fetlock joints. This deformity is to be overcome by such shoeing as will equalize the disparity in length of walls, and by proper boots to protect the fetlocks from interfering.

INTERFERING

An animal is said to interfere when one foot strikes the opposite leg, as it passes by, during locomotion. The inner surface of the fetlock joint is the part most subject to this injury, although, under certain conditions, it may happen to any part of the ankle. It occurs more often in the hind legs than in the fore ones. Interfering causes a bruise of the skin and deeper tissues, generally accompanied

with an abrasion of the surface. It may cause lameness, dangerous tripping, and thickening of the injured parts. (See also p. 364.)

Causes.—Faulty conformation is the usual cause of interfering. When the bones of the leg are so united that the toe of the foot turns in (pigeon-toed), or when the fetlock joints are close together and the toe turns out, when the leg is so deformed that the whole foot and ankle turn either in or out, interfering is almost sure to follow. It may happen, also, when the feet grow too long, from defective shoeing, rough or slippery roads, from the exhaustion of labor or sickness, swelling of the leg, high knee action, fast work, and because the chest or hips are too narrow.

Symptoms.—Generally, the evidences of interfering are easily detected, for the parts are tender, swollen, and the skin broken. But often, especially in trotters, the flat surface of the hoof strikes the fetlock without evident injury, and attention is directed to these parts only by the occasional tripping and unsteady gait. In such cases proof of the cause may be had by walking and trotting the animal, after first painting the inside toe and quarter of the suspected foot with a thin coating of chalk, charcoal, mud, or paint.

Treatment.—When the trouble is due to deformity or faulty conformation it may not be possible to overcome the defect. In such cases, as well as those due to exhaustion or fatigue, the fetlock or ankle boot must be used. In many instances interfering may be prevented by proper shoeing. The outside heel and quarter of the foot on the injured leg should be lowered sufficiently to change the relative position of the fetlock joint by bringing it farther away from the center plane of the body, thereby permitting the other foot to pass by without striking.

A slight change is often sufficient to effect this result. At the same time the offending foot should be so shod that the shoe may set well under the hoof at the point responsible for the injury. The shoe should be reset every 3 or 4 weeks.

When the cause has been removed, cold-water bandages to the injured parts will soon remove the soreness and swelling, especially in recent cases. If, however, the fetlock has become calloused from long-continued bruising, the use of a blister over the parts, repeated in 2 or 3 weeks if necessary, will aid in reducing the leg to its natural condition.

KNUCKLING, OR COCKED ANKLES

Knuckling is a partial dislocation of the fetlock joint, in which the relative position of the pastern bone to the cannon and coronet bones is changed, the pastern becoming more nearly perpendicular, with the lower end of the cannon bone resting behind the center line of the large pastern, while the lower end of this bone rests behind the

center line of the coronet. Although knuckling is not always an unsoundness, it nevertheless predisposes to stumbling and to fracture of the pastern.

Causes.—Young foals are subject to this condition, but in most cases it is only temporary. It is largely due to the fact that before birth the legs were flexed; and time is required after birth for the ligaments, tendons, and muscles to adapt themselves to the function of sustaining the weight of the body.

As they grow old, horses with erect pasterns are prone to knuckle, especially in the hind legs. All kinds of heavy work, particularly in hilly districts, and fast work on hard race tracks or roads are causes of knuckling. It is also commonly seen as an accompaniment of that faulty conformation called clubfoot, in which the toe of the wall is perpendicular and short, and the heels high—a condition most often seen in the mule, especially in the hind feet.

Lastly, knuckling is produced by disease of the suspensory ligament or of the flexor tendons, whereby they are shortened, and by disease of the fetlock joints. (See p. 350.)

Treatment.—In young foals no treatment is necessary, unless there is some deformity, since the legs straighten without interference in the course of a few weeks. When knuckling has commenced, the tendons and ligaments should be relieved by proper shoeing. The foot is to be prepared for the shoe by shortening the toe as much as possible, leaving the heels high; or if the foot is prepared in the usual way the shoe should be thin in front, with thick heels or high calks. For the hind feet a long-heeled shoe with calks seems to do best. When possible, the causes of knuckling should be removed. Since this cannot always be done, however, after a time the patient may no longer be able to perform any work, particularly if both forelegs are affected, and it becomes necessary either to destroy the animal or obtain relief by surgical interference. In such cases the tendons between the fetlock and knee may be divided for the purpose of obtaining temporary relief. Firing and blistering the parts responsible for the knuckling may, in some instances, effect a cure; but a consideration of these measures belongs properly to the treatment of the disease in which knuckling appears simply as a sequel.

WINDGALL

Joints and tendons are furnished with sacs containing a lubricating fluid called synovia. When these sacs are overdistended by reason of an excessive secretion of synovia, they are called windgalls. They form a soft, puffy tumor about the size of a hickory nut, and are most often found in the foreleg, at the upper part of the fetlock joint, between the tendon and the shin bone. When they develop in

the hind leg it is not unusual for them to become as large as a walnut. Occasionally they appear in front of the fetlock on the border of the tendon. Most horses are not subject to them after colthood has passed. (See p. 375.)

Causes.—Windgalls are often seen in young, overgrown horses, in which the body seems to be too large for the joints to sustain the weight. In cart horses and others used to hard work, in trotters with excessive knee action, in hurdle racers and hunters, and in most cow ponies there is a predisposition to windgalls. Horses forced to start heavy loads on slippery streets are the ones most likely to develop windgalls in the hind legs.

Symptoms.—The tumor is more or less firm and tense when the foot is on the ground but is soft and compressible when the foot is off the ground. In old horses windgalls generally develop slowly and cause no inconvenience. If they are caused by excessive tension of the joint, the tumor develops rapidly, is tense, hot, and painful, and the animal is exceedingly lame. The patient stands with the joint flexed and walks with short steps, the toe only being placed on the ground. When the tumor is large and situated on the inside of the leg it may be injured by interfering, causing stumbling and inflammation of the sac. Rest generally causes the tumor to diminish in size, only to fill up again after renewed labor. In cases of long standing, the tumors are hardened and may become converted into bone by a deposit of the lime salts.

Treatment.—The large, puffy joints of suckling colts, as a rule, require no treatment, for as the animal grows older the swelling entirely disappears.

When the trouble is from an injury, complete rest should be obtained by the use of slings and a high-heeled shoe. Cold-water douches should be used once or twice a day, followed by cold-water bandages, until the fever has subsided and the soreness is largely removed, when a blistering agent is to be applied.

In old windgalls, which cause more or less stiffness, some relief may be had by the use of cold-compress bandages, elastic boots, or the red mercury iodide blisters. Opening the sacs, as recommended by some authorities, is of doubtful benefit, and should be done only by a capable veterinarian. Enforced rest until complete recovery is effected should always be insisted on, since a too early return to work is sure to be followed by relapse.

SPRAIN OF THE FETLOCK

Sprain of the fetlock joint is most common in the forelegs, and, as a rule, affects but one at a time. Horses doing fast work, as trotters, runners, steeplechasers, hunters, cow ponies, and those that interfere, are particularly liable to this injury.

Causes.—Horses knuckling at the fetlock, and all those with diseases that impair the powers of locomotion, such as navicular disease, contracted heels, sidebones, or chronic laminitis, are predisposed to sprains of the fetlock. It generally happens from a misstep, stumbling, or slipping, which results in the joint being extended or flexed to excess. The same result may occur if the foot is caught in a rut, a hole in a bridge, or in a car track, and the animal falls or struggles violently. Direct blows and punctured wounds may also set up inflammation of the joint.

Symptoms.—The symptoms of sprain of the fetlock vary with the severity of the injury. If slight, there may be no lameness but simply a little soreness, especially when the foot strikes on uneven ground and the joint is twisted a little. In more severe cases the joint swells, is hot and puffy, and the lameness may be so intense as to compel the animal to hobble on three legs. While at rest, the leg is flexed at the joint affected, and the toe rests on the ground.

Treatment.—If the injury is slight, cold-water bandages and a few days' rest are sufficient to effect recovery. When there is an intense lameness and swelling, the leg should be placed under a constant stream of cold water, as described in the treatment for quittor. When the inflammation has subsided, a blistering agent should be applied to the joint.

In some cases, especially in old horses long accustomed to fast work, the ligaments of the joints are ruptured, in whole or in part, and the lameness may last a long time. In these cases the joint should be kept completely at rest; this condition is best obtained by the application of plaster of paris bandages, as in fracture. As a rule, patients are not annoyed by this type of bandage, and, while wearing it, may be given the freedom of a roomy box or yard. If they are disposed to tear it off, or if sufficient rest cannot otherwise be obtained, the animals must be kept in slings.

In most instances the plaster bandage should remain on 2 to 4 weeks. If the lameness returns when the bandage is removed, a new one should be put on. The swelling, which always remains after the other evidences of the disease have disappeared, may be largely dissipated and the joint strengthened by the use of the firing iron and blisters.

A joint once injured by a severe sprain never entirely regains its original strength and is ever after particularly liable to a repetition of the injury.

RUPTURE OF THE SUSPENSORY LIGAMENT

Sprain with or without rupture of the suspensory ligament may occur in either the fore or hind legs and is occasionally seen in horses of all classes and at all ages. Old animals, however, especially

hunters, runners, and trotters, are the most subject to this injury, and with them the seat of the trouble is nearly always in one or both forelegs. Horses used for heavy draft are more likely to have the ligament of the hind legs affected.

When the strain on the suspensory ligament becomes too great, one or both of the branches may be torn from the sesamoid bones, one or both of the branches may be torn completely across, or the ligament may rupture above the point of division.

Symptoms.—The most common injury to the suspensory ligament is sprain of the internal branch in one of the forelegs. The trouble is indicated by lameness, heat, swelling, and tenderness of the affected branch, beginning just above the sesamoid bone and extending obliquely downward and forward to the front of the ankle. If the whole ligament is involved, the swelling comes on gradually and is found above the fetlock and in front of the flexor tendons. The animal stands or walks on the toe as much as possible and keeps the fetlock joint flexed to relieve the ligament of tension.

When both branches are torn from their attachments to the sesamoids, or both are torn across, the lameness comes on suddenly and is most intense; the fetlock descends, the toe turns up, and as the animal attempts to walk, the leg has the appearance of being broken off at the fetlock. These symptoms, followed by heat, pain, and swelling of the parts at the point of injury, will enable anyone to make a diagnosis.

Treatment.—Sprain of the suspensory ligament, no matter how mild it may be, should always be treated by enforced rest of at least a month and the application of cold douches and cold-water bandages, firmly applied until the fever has subsided, when a blistering agent should be put on and repeated in 2 or 3 weeks if necessary. When rupture has taken place the patient should be put into slings and a constant stream of cold water allowed to trickle over the seat of injury until the fever is reduced. In the course of a week or 10 days a plaster of paris splint, such as is used in fractures, should be applied and left on for a month or 6 weeks. When this is taken off, a blistering agent may be used to remove the remaining soreness; but it is useless to expect a removal of all the thickening, for, in the process of repair, new tissue has been formed that will always remain.

In old cases of sprain the firing iron may often be used with good results. As a rule, severe injuries to the suspensory ligament incapacitate the subject for anything but slow, light work.

OVERREACH

When the shoe of the hind foot strikes and injures the heel or quarter of the forefoot the horse is said to overreach. It rarely happens except when the animal is going fast; hence it is most common in trot-

ting and running horses. In trotters the accident generally occurs when the animal breaks from a trot to a run. The outside heels and quarters are most liable to the injury.

Symptoms.—The coronet at the heel or quarter is bruised or cut, the injury in some instances involving the horn as well. When the hind foot strikes well back on the heel of the forefoot—an accident known among horsemen as “grabbing”—the shoe may be torn from the forefoot or the animal may fall to its knees. Horses accustomed to overreaching are often “bad breakers,” for the reason that the pain of the injury so excites them that they cannot readily be brought back to the trotting gate.

Treatment.—If the injury is but a slight bruise, cold-water bandages applied for a few days will remove all the soreness. If the parts are deeply cut, more or less suppuration will follow, and, as a rule, it is well to poultice the parts for a day or two, after which cold baths may be used, or the wounds dressed with an antiseptic solution, oakum, and a roller bandage.

When an animal is known to be subject to overreaching, it should never be driven fast without quarter boots, which are specially made for the protection of the heels and quarters.

If there is a disposition to “grab” the forward shoes, the trouble may be remedied by having the heels of these shoes made as short as possible, and the toe of the hind foot should project well over the shoe. When circumstances permit their use, the forefeet may be shod with the “tips” instead of the common shoe, as described in treatment for contracted heels.

CALK WOUNDS

Horses wearing shoes with sharp calks are liable to wounds of the coronary region, either from trampling on themselves or on each other. These injuries are most common in heavy draft horses, especially on rough roads and slippery streets. The forefeet are more liable to injury than the hind ones, and the seat of injury is commonly on the quarters. In the hind feet the wound often results from the animal's resting with the heel of one foot set directly over the front of the other. In these cases the injury is generally close to the horn and often involves the coronary band, the sensitive laminae, the extensor tendon, and even the coffin bone.

Treatment.—Preventive measures include the use of boots to protect the coronet of the hind foot and of a blunt calk on the outside heel of the fore shoe, since this is generally the offending instrument when the forefeet are injured. If the wound is not deep and the soreness slight, cold-water bandages and a light protective dressing, such as carbolyzed petroleum, will be all that is needed. When the

injury is deep, followed by inflammation and suppuration of the coronary band, lateral cartilages, or sensitive laminae, active measures must be resorted to. Cold, astringent baths may be used, followed by poultices, if it is necessary to hasten the cleansing of the wound by stimulating the sloughing process. If the wound is deep between the horn and the skin, especially over the anterior tendon, the horn should be cut away so that the injured tissues may be exposed. The subsequent treatment in these cases should follow the directions given in the article on toe cracks.

FROSTBITES

Except for the ears, the feet and legs are the only parts of the horse likely to become frostbitten. In mountainous districts, where the snowfall is heavy and the cold often intense, frostbites are common, even among animals running at large.

Symptoms.—When the frosting is slight the skin becomes pale and bloodless, followed soon after by intense redness, heat, pain, and swelling. In these cases the hair may fall out and the epidermis peel off, but the inflammation soon subsides, the swelling disappears, and only an increased sensitiveness to cold remains.

In more severe cases irregular patches of skin are destroyed and after a few days slough away, leaving slow-healing ulcers. If the frosting is produced by low temperatures and deep snow, the coronary band is the part most often affected.

In many instances there is no destruction of the skin but simply a temporary suspension of the horn-producing function of the coronary band. The forefeet are more often affected than the hind ones, and the heels and quarters are less often involved than the front part of the foot. The coronary band becomes hot, swollen, and painful, and after 2 or 3 days the horn separates from the band and slight suppuration follows. For a few days the animal is lame, but as the suppuration disappears the lameness subsides. New horn, often of an inferior quality, is produced by the coronary band, and in time the cleft is grown off and complete recovery is effected. The frog is occasionally frostbitten and may slough off, exposing the soft tissues beneath and causing severe lameness for a time.

Treatment.—Simple frostbites are best treated by cold applications followed by applications of a 5-percent solution of carbolized oil. When portions of the skin are destroyed, their early separation should be hastened by warm fomentations and poultices. Ulcers should be treated by the application of stimulating dressings, with pads of oakum and flannel bandages. In many of these cases recovery is exceedingly slow. The new tissue by which the destroyed skin is replaced always shrinks in healing, and, as a consequence, unsightly scars are un-

avoidable. When the coronary band is involved it is generally advisable to blister the coronet over the seat of injury as soon as the suppuration ceases, for the purpose of stimulating the growth of new horn. Where a crevice is formed between the old and the new horn, no serious trouble is likely to be met with until the cleft is nearly grown out, when the soft tissues may be exposed by a breaking off of the partly detached horn. But even if this accident happens, final recovery is effected by poulticing the foot until a sufficient growth of horn protects the parts from injury.

QUITTOR

"Quittor" is a term applied to various affections of the foot wherein the involved tissues undergo a process of degeneration that results in the formation of a slough followed by the elimination of the diseased structures by means of a more or less extensive suppuration.

For convenience of consideration quittors may be divided into four classes, as suggested by Girard: (1) Cutaneous quittor, which is known also as simple quittor, skin quittor, and carbuncle of the coronet; (2) tendinous quittor; (3) subhorny quittor; and (4) cartilaginous quittor.

CUTANEOUS QUITTOR

Cutaneous quittor consists in a local inflammation of the skin and subcutaneous connective tissue on some part of the coronet, followed by a slough and the formation of an ulcer that heals after suppuration.

It is an extremely painful disease, owing to the dense character of the tissues involved; for in all dense structures the swelling that accompanies inflammation always produces intense pressure. This pressure not only adds to the patient's suffering but may at the same time endanger the life of the affected parts by strangulating the blood vessels. More than two-thirds of cases of this class of quittor develop in the forefeet. Although any part of the coronet may become the seat of attack, the heels and quarters are undoubtedly most liable.

Causes.—Bruises and other wounds of the coronet are often the cause of cutaneous quittor, but in most cases there is no known cause. For some reason not yet satisfactorily explained most cases occur in the fall of the year. One explanation of this fact is that the disease is due to the injurious action of cold and mud. This, however, is questionable since in many parts of this country the most mud, accompanied with freezing and thawing weather, is seen in the early springtime without a corresponding increase of quittor. Furthermore, the serious outbreaks of this disease in the mountainous sections of Colorado, Wyoming, and Montana are seen in the fall and winter seasons, when the weather is the driest. However, during these seasons, when the water is low, animals are compelled to wade through

more mud to drink from lakes and pools than is necessary at other seasons of the year, when these lakes and pools are full. Add to these conditions the further fact that much of this mud is impregnated with alkaline salts that are more or less irritating, and it seems fair to conclude that under certain circumstances mud may be an important factor in the production of quittor.

Although this disease attacks all classes of horses, the large, common breeds, with thick skins, heavy coats, and coarse legs are most often affected. Horses well groomed and cared for in stables seem to be less liable to the disease than those running at large or those kept and worked under adverse circumstances.

Symptoms.—Lameness, lasting from 1 to 4 days, nearly always precedes the development of the strictly local evidences of quittor. The next sign is the appearance of a small, tense, hot, and painful tumor in the skin of the coronary region. If the skin of the affected foot is white, the inflamed portion will be dark red or even purplish near the center. Within a few hours the ankle, or even the whole leg as high as the knee or hock, becomes much swollen. The lameness is now so great that the animal refuses to use the foot at all, but carries it if compelled to move. As a consequence, the opposite leg is required to do the work of both, and if the animal persists in standing a greater part of the time it, too, becomes swollen. In many of these cases the suffering is so intense during the first few days as to cause general fever, dullness, loss of appetite, and increased thirst. Generally the tumor shows signs of suppuration within 48 to 72 hours after its first appearance; the summit softens, a fluctuating fluid is felt beneath the skin, which soon ulcerates completely through, causing the discharge of a thick, yellow, bloody pus, containing shreds of dead tissue that have sloughed away. The sore is now converted into an open ulcer, generally deep, nearly or quite circular in outline, and with hardened base and edges. In exceptional cases large patches of skin, varying from 1 to 2½ inches in diameter, slough away at once, leaving an ugly, superficial ulcer. These sores, especially when deep, suppurate freely, and if there are no complications they tend to heal rapidly as soon as the degenerated tissue has softened and is entirely removed. When suppuration is fully established, the lameness and general symptoms subside. When but a single tumor and abscess form, the disease progresses rapidly, and recovery, under proper treatment, may be effected in 2 to 3 weeks; but when two or more tumors are developed at once, or if the formation of one tumor is rapidly succeeded by another for an indefinite time, the sufferings of the patient are greatly increased, the case is more difficult to treat, and recovery is slower and less certain.

This form of quittor is often complicated with the tendinous and subhorny quitters by an extension of the sloughing process.

Treatment.—The first step in the treatment of an outbreak of quittor should be the removal of all exciting causes. Crowding animals into small corrals and stables, where injuries to the coronet are likely to occur from trampling, especially among unbroken range horses, must be avoided as much as possible. Watering places accessible to animals without their having to wade through mud should be provided.

The treatment of cutaneous quittor varies with the stage of the disease. If the case is seen before any of the signs of suppuration have developed, the affected foot should be placed under a constant stream of cold water, with the object of arresting a further extension of the inflammatory process. To accomplish this, put the patient in slings in a narrow stall having a slat or open floor. Bandage the foot and leg to the knee or hock, as the case may be, with flannel bandages loosely applied. Set a tub or barrel filled with cold water above the patient, and by the use of a small rubber hose of sufficient length make a siphon that will carry the water from the bottom of the tub to the leg at the top of the bandage. The stream of water should be rather small and is to be continued until the inflammation has entirely subsided or until the presence of pus can be detected in the tumor. When suppuration has commenced, the process should be aided by the use of warm baths and poultices. If the tumor is of rapid growth, accompanied with intense pain, relief is obtained and sloughing largely limited by a free incision of the parts. The incision should be vertical and deep into the tumor, care being taken not to divide the coronary band entirely. If the tumor is large, more than one incision may be necessary. The foot should now be placed in a warm bath for half an hour or longer and then poulticed. The hemorrhage produced by the cutting and by the warm bath is generally very copious and soon gives relief to the overtension of the parts.

In other cases it will be found that suppuration is well under way, so that the center of the tumor is soft when the patient is first presented for treatment. It is always good surgery to relieve the tumor of pus whenever its presence can be detected; hence, in these cases a free incision must be made into the softened parts, the pus evacuated, and the foot poulticed. By surgical interference the tumor is now converted into an open sore or ulcer, which, after it has been well cleaned by warm baths and poultices applied for 2 or 3 days, needs to be protected by proper dressings. The best of all protective dressings is made of small balls, or pledgets, of oakum, carefully packed into the wound and held in place by a roller bandage 4 yards long, from 3 to 4 inches wide, made of common bedticking and skillfully applied. The balls of oakum are wet with an antiseptic solution before they are applied to the wound. If the wound is slow to heal, it will be of advantage to change the dressing and antiseptic every few days.

If the granulations continue to grow until a tumor is formed that projects beyond the surrounding skin, it should be cut off with a sharp, clean knife, and the foot poulticed for 24 hours, after which the wound should be well cauterized daily with lunar caustic and the bandages applied with great firmness.

The question as to how often the dressings should be renewed must be determined by the condition of the wound. If the sore is discharging freely, it will be necessary to renew the dressing every 24 to 48 hours; if the discharge is small in quantity and the patient comfortable, the dressing may be left on for several days; in fact, the less often the wound is disturbed, the better, so long as the healing process is healthy. When the sore commences to "skin over," the edges should be lightly touched with lunar caustic at each dressing. The patient may now be given a little exercise daily, but the bandages must be kept on until the wound is entirely healed.

TENDINOUS QUITTOR

This form of quittor differs from the cutaneous in that it not only affects the skin and subcutaneous tissues but involves also the tendons of the leg, the ligaments of the joints, and, in many cases, the bones of the foot.

Fortunately, this form of quittor is less common than the preceding, yet any case beginning as simple cutaneous quittor may at any time during its course become complicated by the death of some part of the tendons, by gangrene of the ligaments, sloughing of the coronary band, caries of the bones, or inflammation and suppuration of the synovial sacs and joints, thereby converting a simple quittor into one that will, in all probability, either destroy the patients' life or maim it for all time.

Causes.—Tendinous quittor is caused by the same injuries and influences that produce the cutaneous form. One authority believes it to be a frequent accompaniment of distemper. The author has seen nothing to verify this belief, but young animals seem to be more likely to have tendinous quittor than older ones, and they are much more likely to make a good recovery.

Symptoms.—When a case of cutaneous quittor is transformed into the tendinous variety, there is a sudden increase in the severity of all the symptoms. On the other hand, if the attack primarily is one of tendinous quittor, the earliest symptom is a well-marked lameness. In those cases due to causes other than injuries this lameness is at first slight, and the animal limps no more in trotting than in walking; later on, generally during the next 48 hours, the lameness increases to such an extent that the animal often refuses to use the leg at all. An examination made during the first 2 days rarely dis-

closes any cause for this lameness; it may not be possible even to say with certainty that the foot is the seat of the trouble. On the third or fourth day, sometimes as late as the fifth, a doughy-feeling tumor will be found forming on the heel or quarter. This tumor grows rapidly, feels hot to the touch, and is extremely painful. As the tumor develops, all the other symptoms increase in intensity. The pulse is rapid and hard, the breathing quick, the temperature elevated 3° or 4° , the appetite is gone, thirst increased, and the lameness so great that the foot is carried if locomotion is attempted. At this stage of the disease the animal generally seeks relief by lying on the broad side, with outstretched legs; the coat is covered with a clammy sweat, and every respiration is accompanied with a moan. The leg soon swells to the fetlock; later this swelling gradually extends to the knee or hock, and in some cases reaches the body. As a rule, several days elapse before the disease develops a well-defined abscess, for, owing to the dense structure of the bones, ligaments, and tendons, the suppurative process is a slow one, and the pus is prevented from readily collecting in a mass.

The author made a post mortem examination on a typical case of this disease, in which the animal had died on the fourth day after being found on the range slightly lame. The suffering had been intense, yet the only external evidences of the disease consisted in the shedding of the hoof from the right forefoot and a limited swelling of the leg to the knee. The sloughing of the hoof took place 2 or 3 hours before death and was accompanied with but little suppuration and no hemorrhage. The skin from the knee to the foot was thickened from watery infiltration (edema), and on the inside quarter three holes, each about one-half inch in diameter, were found. All had ragged edges but only one had gone deep enough to perforate the coronary band. The loose connective tissue beneath the skin was distended, with a gelatinous infiltration over the whole course of the flexor tendons and to the fetlock joint over the tendon in front. The soft tissues covering the coffin bone were loosened in patches by collections of pus that had formed beneath the sensitive laminae. The coffin and pastern joints were inflamed, as were also the coffin, navicular, and coronet bones, and the outside toe of the coffin bone had become softened from suppuration until it readily crumbled between the fingers. The coronary band was largely destroyed and completely separated from the other tissues of the foot. The inner lateral cartilage was gangrenous, as was also a small spot on the extensor tendon near its point of attachment on the coffin bone. Several small collections of pus were found deep in the connective tissue of the coronary region, along the course of the sesamoid ligaments, in the sheath of the flexor tendons, under the tendon just below the fetlock joint in front, and in the coffin joint.

But all cases of tendinous quittor are by no means so complicated as this one. In rare instances the swelling is slight, and after a few days the lameness and other symptoms subside, without any discharge of pus from an external opening. In most cases, however, from one to half a dozen or more soft points arise on the skin of the coronet, open, and discharge slowly a thick, yellow, fetid, and bloody matter. In other cases the suppurative process is largely confined to the sensitive laminae and plantar cushion, when the suffering is intense until the pus finds an avenue of escape by separating the hoof from the coronary band, at or near the heels, without causing a loss of the whole horny box. When the flexor tendon is involved deep in the foot, the discharge of pus usually takes place from an opening in the hollow of the heel; if the sesamoid ligament or the sheath of the flexors is affected, the opening is nearer the fetlock joint, although in most of these cases the suppuration spreads along the course of the tendons until the navicular joint is involved, and extensive sloughing of the deeper parts follows.

Treatment.—The treatment of tendinous quittor should be directed toward saving the foot. First of all an effort must be made to prevent suppuration. If the patient is seen at the beginning, cold irrigation, recommended in the treatment for cutaneous quittor, should be resorted to. Later, when the tumor is forming on the coronet, the knife must be used, and a free and deep incision made into the swelling. Whenever openings appear, from which pus escapes, they should be carefully probed; in all instances these fistulous tracts lead down to dead tissue that nature is trying to remove by the process of sloughing. If a counter opening can be made, which will enable a more ready escape of the pus, it should be done at once; for instance, if the probe shows that the discharge originates from the bottom of the foot, the sole must be pared through over the seat of trouble. Whenever suppuration has commenced the process is to be stimulated by the use of warm baths and poultices. The pus that accumulates in the deeper parts, especially along the tendons, around the joints, and in the hoof, should be removed by pressure and injections made with a small syringe, repeated two or three times a day. As soon as the discharge assumes a healthy character and diminishes in quantity, stimulating solutions are to be injected into the open wounds. When the tendons, ligaments, and other deeper parts are affected, a strong solution of carbolic acid—1 to 4—should be used at first; or strong solutions of tincture of iodine may be used in place of the carbolic acid; after this the remedies and dressings directed for use in simple quittor are to be used. In those cases in which the fistulous tracts refuse to heal it is often necessary to resort to surgery.

But no matter what treatment is adopted, a large percentage of the cases of tendinous quittor fail to make good recoveries. If the

entire hoof sloughs away, the growth of a new, but soft and imperfect hoof may be obtained by carefully protecting the exposed tissues with proper bandages. When the joints are opened by deep sloughing, recovery may eventually take place, but the joint remains immovable ever after. If caries of a small part of the coffin bone takes place, it may be removed by an operation; but if much of the bone is affected, or if the navicular and coronet bones are involved in the carious process, the only hope for a cure is in the amputation of the foot. This operation is advisable only when the animal is valuable for breeding purposes. In all other cases in which there is no hope for recovery the animal should be killed. In tendinous quittor much thickening of the coronary region, and sometimes of the ankle and fetlock, remains after suppuration has ceased and the fistulous tracts have healed. To stimulate the reabsorption of this new and unnecessary tissue, the parts should be fired with the hot iron, or, in its absence, repeated blistering may largely accomplish the same results.

SUBHORN Y QUITTOR

This is the most common form of the disease. It is generally seen in but one foot at a time, and more often in the fore than in the hind feet. It nearly always attacks the inside quarter but may affect the outside, the band in front, or the heel, where it is of little consequence. It consists in the inflammation of a small part of the coronary band and adjacent skin, followed by sloughing and suppuration, which in most cases extends to the neighboring sensitive laminae.

Causes.—Injuries to the coronet, such as bruises, overreaching, and calk wounds, are considered as the common causes of this disease. Still, cases occur in which there appears to be no existing cause, just as in the other forms of quittor, and it seems fair to conclude that subhorny quittor may also be produced by internal causes.

Symptoms.—At the outset the lameness is always severe, and the animal often refuses to use the affected foot. Swelling of the coronet close to the top of the hoof causes the quarter to protrude beyond the wall. This tumor is extremely sensitive, and the whole foot is hot and painful. After a few days a small spot in the skin, over the most elevated part of the tumor, softens and opens or the hoof separates from the coronary band at the quarter or well back toward the heel. From this opening, wherever it may be, a thin, watery, often dark, offensive discharge escapes, at times mixed with blood and always containing a considerable percentage of pus.

Probing will now disclose a fistulous tract leading to the bottom of the diseased tissues. If the opening is small, there is a tendency on the part of the suppurative process to spread downward; the pus gradually separates the hoof from the sensitive laminae until the sole is reached, and even a portion of this may be undermined.

As a rule, the slough in this form of quittor is not deep, and if the case receives early and proper treatment complications are generally avoided; but if the case is neglected, and, occasionally, even in spite of the best treatment, the disease spreads until the tendon in front, the lateral cartilage, or the coffin bone and joint as well are involved.

In all cases of subhorny quittor much relief is experienced when the slough comes away, and rapid recovery is made. If, however, after the lapse of a few days, the lameness remains and the wound continues to discharge a thin pus, the probabilities are that the disease is spreading, and pus collecting in the deeper parts of the foot. If the use of the probe now detects a pus cavity below the opening, a cartilaginous quittor may be in the course of development.

Treatment.—Hot baths and poultices should be used until the presence of pus can be determined, when the tumor is to be opened with a knife or sharp-pointed iron heated white hot. The hot baths and poultices are now continued for a few days or until the entire slough has come away and the discharge is diminished, when dressings recommended in the treatment for cutaneous quittor are to be used until recovery is completed. In cases in which the discharge comes from a cleft between the upper border of the hoof and the coronary band, always pare away the loosened horn, so that the soft tissues beneath are fully exposed, care being taken not to injure the healthy parts. This operation permits a thorough inspection of the diseased parts, the easy removal of all gangrenous tissue, and a better application of the necessary remedies and dressings. The only objection to the operation is that the animal is prevented from being returned to work soon.

When the probe shows that pus has collected under the coffin bone the sole must be pared through, and, if caries of the bone is present, the dead parts cut away. After either of these operations the wound is to be dressed with the oakum balls, saturated in an antiseptic solution, as previously directed, and the bandages tightly applied. Generally the discharge for the first 2 or 3 days is so great that the dressings need to be changed every 24 hours; but when the discharge diminishes, the dressing may be left on from 1 to 2 weeks. Before the animal is returned to work, a bar shoe should be applied, since the removed quarter or heel can be made perfect again only by a new growth from the coronary band.

Tendinous or cartilaginous complications are to be treated as directed under those headings.

CARTILAGINOUS QUITTOR

This form of quittor may commence as a primary inflammation of the lateral cartilage, but in most cases it appears as a sequel to cutaneous or subhorny quittor. It may affect either the fore or hind feet

but is most common in the former. As a rule, it attacks but one foot at a time, and but one of the cartilages, generally the inner one. It is always a serious affection for the reason that, in many cases, it can be cured only by a surgical operation, requiring a thorough knowledge of the anatomy of the parts involved and much surgical skill.

Causes.—Direct injuries to the coronet, such as trampling, pricks, burns, and the blow of some heavy falling object that may puncture, bruise, or crush the cartilage are the common direct causes of cartilaginous quittor. Besides being a sequel to the other forms of quittor, it sometimes develops as a complication in suppurative corn, canker, grease, laminitis, and punctured wounds of the foot. Animals used for heavy draft and those with flat feet and low heels are more liable to the disease than others, for the reason that they are more exposed to injury. Rough roads also predispose to the disease by increasing liability to injury.

Symptoms.—When the disease commences as a primary inflammation of the cartilage, lameness develops with the formation of a swelling on the side of the coronet over the quarter. The severity of this lameness depends largely on the part of the cartilage that is diseased, for if the disease is situated in that part of the cartilage nearest the heel, where the surrounding tissues are soft and spongy, the lameness may be slight, especially if the animal is required to go no faster than a walk; but when the middle and anterior parts of the cartilage are diseased, the pain and consequent lameness are much greater, for the tissues are less elastic and the coffin joint is more likely to become affected.

Except in the cases noted hereafter, one or more fistulous openings finally appear in the tumor on the coronet. These openings are surrounded by a small mass of granulations that are elevated above the adjacent skin and bleed readily if handled. A probe shows these fistulous tracts to be more or less sinuous, but always leading to one point—the gangrenous cartilage. When cartilaginous quittor occurs as a complication of suppurative corn or from punctured wounds of the foot, the fistulous tract may open only at the point of injury on the sole.

The discharge in this form of quittor is generally thin, watery, and contains pus enough to give it a pale-yellow color; it has an offensive odor owing to the detachment of small flakes of cartilage that have become gangrenous and are seen in the discharge as small, greenish-colored particles. In cases of long standing, it is not unusual to find some of the fistulous openings heal at the surface; this is followed by the gradual collection of pus in the deeper parts, forming an abscess, which in a short time opens at a new point. The wall of the hoof, over the affected quarter and heel, in cases of very long standing

becomes rough and wrinkled like the horn of a ram, and generally it is thicker than the corresponding quarter, owing to the stimulating effect that the disease has on the coronary band.

Complications may arise by an extension of the disease to the lateral ligament of the coffin joint, to the joint itself, to the plantar cushion, and by caries of the coffin bone.

Treatment.—Before recovery can take place all the dead cartilage must be removed. In rare instances this is effected by nature without assistance. Usually, however, the disease does not tend to recovery, and active curative measures must be adopted. The best and simplest treatment, in most cases, is the injection of strong caustic solutions, which destroy the diseased cartilage and cause its discharge, along with the other products of suppuration. In favorable cases these injections result in the healing of the wound in 2 to 3 weeks. No matter which remedy may be selected, however, it must be used at least twice a day for a time. The solution is injected into the various openings with force enough to drive it to the bottom of the wound, after which the foot is to be dressed with a pad of oakum, held in place by a roller bandage tightly applied. Although it is not always necessary, it is often of advantage to relieve the pressure on the parts by rasping away the hoof over the seat of the cartilage; the coronary band and laminae should not be injured in the operation.

If the caustic injections are successful, the discharge will become healthy and gradually diminish, so that by the end of the second week the fistulous tracts are closing up and the injections are made with much difficulty. If, on the other hand, there is little or no improvement after this treatment has been used for 3 weeks, the operation for the removal of the lateral cartilage must be resorted to. As this operation can be safely undertaken only by an expert veterinarian, it is not described in this connection.

THRUSH

Thrush is characterized by an excessive secretion of unhealthy pus from the cleft of the frog. Although all classes of horses are liable to this affection, it is more often seen in the common draft horse than in any other breed, owing to the conditions of servitude and not to the fault of the breed. Country horses are much less subject to the disease, except in wet, marshy districts, than are horses used in cities and towns.

Causes.—The most common cause of thrush is the filthy condition of the stable in which the animal is kept. When filth is the cause, mares are more likely to contract the disease in the hind feet, and the gelding and stallion to develop it in the forefeet. Hard work on rough and stony roads may also induce the disease, as may a change from dryness to excessive moisture. The latter cause often operates

in old track horses, whose feet are constantly soaked for the purpose of relieving soreness. Muddy streets and roads, especially where mineral substances are plentiful, excite this abnormal condition of the frog. Contracted heels, scratches, and navicular disease predispose to thrush, and some authorities believe that a constitutional tendency exists among some affected animals.

Symptoms.—At first there is simply an increased moisture in the cleft of the frog, accompanied with an offensive smell. After a time a considerable discharge takes place—thin, watery, and highly offensive, changing gradually to a thicker puriform pus, which rapidly destroys the horn of the frog. Only in old and severe cases is the patient lame and the foot feverish—cases in which the whole frog is involved in the diseased process.

Treatment.—Thrushes are to be treated by cleanliness, the removal of all exciting causes, and a return of the frog to its normal condition. As a rule, the diseased and ragged portions of horn are to be pared away and the foot poulticed for a day or two. The cleft of the frog and the grooves on its edges may then be cleaned and well filled with dry calomel and the foot dressed with oakum and a roller bandage. If the discharge is profuse, the dressing should be changed daily; otherwise it may be left on 2 or 3 days. With swelling of the legs, grease-heel, etc., a purgative, and other systemic treatment, may be prescribed. If the growth of horn seems too slow, the application of a blister to the heels is often followed by good results. Feet in which the disease is readily induced may be protected in the stable with a leather boot. If the thrush is but a sequel to other disease, a permanent cure may not be possible.

CANKER

Canker of the foot not only destroys the sole and frog, but, by setting up a chronic inflammation in the deeper tissues, prevents the growth of a healthy horn by which the injury may be repaired. Heavy cart horses are more often affected than those of any other class.

Causes.—The condition most favorable to the development of canker is dampness—in fact, the disease is rarely seen in high, dry districts and is much more common in rainy than in dry seasons. Filthy stables and muddy roads are considered to be the causes of canker; but it is doubtful whether these conditions can do more than favor a preparation of the foot for the reception of infection.

All injuries to the feet, by exposing the soft tissues, may render the animal susceptible to infection; but neither the injury nor the irritation and inflammation of the tissues that follow are sufficient to induce the disease. For some unknown reason horses with lymphatic

temperaments—thick skins, flat feet, fleshy frogs, heavy hair, and particularly with white feet and legs—are especially liable to canker.

Symptoms.—Usually, canker is confined to one foot; but it may attack two, three, or all the feet at once; or, more commonly, the disease attacks first one and then another, until all may have been successively affected. When the disease follows an injury that has exposed the soft tissues of the foot, the wound shows no tendency to heal, but instead there is secreted from the inflamed parts a profuse, thin, fetid, watery discharge, which gradually undermines and destroys the surrounding horn, until a large part of the sole and frog is diseased. The living tissues are swollen, dark colored, and covered at certain points with particles of new, soft, yellowish, thready horn, which are constantly undergoing maceration in the abundant liquid secretion by which they are immersed. As this secretion escapes to the surrounding parts, it dries and forms small, cheesy masses composed of partly dried horny matter, exceedingly offensive in odor. When the disease originates independently of an injury, the first evidences of the trouble are the offensive odor of the foot, the liquid secretion from the cleft and sides of the frog, and the rotting away of the horn of the frog and sole.

In the earlier stages there is no interference with locomotion, but later the foot becomes sensitive, particularly if the animal is used on rough roads, and, finally, when the sole and frog are largely destroyed the lameness is severe.

Treatment.—Since canker does not destroy the power of the tissues to produce horn, but rather excites them to an excessive production of an imperfect horn, the treatment should be directed to restoring the parts to a normal condition, when healthy horn may again be secreted. The old practice of stripping off the entire sole and deep cauterization, with either the hot iron or strong acids, is not attended with uniformly good results. Recovery can generally be effected as surely and as speedily with much less painful measures. The persistent application of simple remedies and great cleanliness are more effective than any particular drug.

First, then, clean the foot with warm baths and apply a poultice containing powdered charcoal or carbolic acid. A handful of the charcoal or a tablespoonful of the acid mixed with the poultice destroys much of the offensive odor. The diseased portions of horn are to be carefully removed with sharp instruments, until only healthy horn borders the affected parts. The edges of the sound horn should be pared thin so that the swollen soft tissues may not overlap their borders. With sharp scissors cut off all the prominent points on the soft tissues, shorten the walls of the foot, and nail on a broad, plain shoe. The foot is now ready for the dressings, and

stimulating and drying agents may be used; but it may be necessary to change frequently from one to another.

A good practice is to give the newly shod foot a bath for an hour or two in an astringent solution. When the foot is removed from the bath it is dressed with oakum balls dipped in a stimulating antiseptic solution. The diseased parts being well covered with the balls, a pad of oakum sufficiently thick to cause considerable pressure is placed over them, and all are held in place by pieces of heavy tin fitted to slip under the shoe. The whole foot is now incased in a boot or folded gunny sack and the animal turned into a loose, dry box stall. The dressings are to be changed daily or even twice a day at first. When they are removed, all pieces of new horny matter that are now firmly adherent must be rubbed off with the finger or a tent of oakum. As the secretion diminishes, dry powders, such as calomel, may be of most advantage. When the soft tissues are all horned over, the dressings should be continued for a time, weak antiseptic solutions being used to prevent a recurrence of the disease. If the animal is run down in condition, bitter tonics may be given and a liberal diet of grain allowed.

CORNS

A corn is an injury to the living horn of the foot, involving the soft tissues beneath, whereby the capillary blood vessels are ruptured and a small quantity of blood escapes which, by permeating the horn in the immediate neighborhood, stains it a dark color. If the injury is continuously repeated, the horn becomes altered in character and the soft tissues may suppurate or a horny tumor develop. Corns always appear in the sole in the angle between the bar and the outside wall of the hoof. In many cases the laminae of the bar, of the wall, or of both, are involved at the same time.

Three kinds of corns are commonly recognized—the dry, the moist, and the suppurative—a division based solely on the character of the conditions that follow the primary injury.

The forefeet are almost exclusively affected, for two reasons: (1) Because they support a greater part of the body; (2) because the heel of the forefoot during progression is first placed upon the ground, whereby it receives much more concussion than the heel of the hind foot, in which the toe first strikes the ground. The heavier breeds of horses generally used for heavy work on rough roads and streets seem to be most liable to this trouble. Mules rarely have corns.

Causes.—Among the causes and conditions that predispose to corns are high heels, which change the natural relative position of the bones of the foot and thereby increase the concussion to which

these parts are subject; contracted heels, which in part destroy the elasticity of the foot, increase the pressure upon the soft tissues of the heel, and render lacerations more easy; long feet, which by removing the frog and heels too far from the ground deprive them of necessary moisture (this, in turn, reduces the elastic properties of the horn and diminishes the transverse diameter of the heels); weak feet, or those in which the horn of the wall is too thin to resist the tendency to spread, whereby the soft tissues are easily lacerated. Wide feet with low heels are always accompanied with a flat sole whose posterior wings either rest upon the ground or the shoe, and as a consequence are easily bruised. At the same time the arch of the sole is so broad and flat that it cannot support the weight of the body, and in the displacement that occurs when the foot is rested on the ground the soft tissues are likely to become bruised or torn.

Shoeing, either as a direct or predisposing cause, is most prolific in producing corns. One of the most serious as well as the most common of the errors in shoeing is in the preparation of the foot. Instead of seeking to maintain the integrity of the arch, the first thing done is to weaken it by freely paring away the sole; nor does the mutilation end here, for the frog, which is nature's main support to the branches of the sole and the heels, is also largely cut away. This not only permits an excessive downward movement of the contents of the horny box, but it at the same time removes the one great means by which concussion of the foot is prevented. Other errors are faults of construction in the shoe and in the way it is adjusted to the foot. An excess of concavity in the shoe, extending it too far back on the heels, high calks, thin heels that permit the shoe to spring, short heels with a calk set under the foot, and a shoe too light for the animal wearing it or for the work required of it, are all to be avoided as causes of corns. A shoe set so as to press on the sole or one that has been on so long that the hoof has overgrown it until the heels rest on the sole and bars is a direct cause of corns. Indirectly the shoe causes corns when small stones, hard, dry earth, or other objects collect between the sole and shoe. Lastly, a rapid gait and excessive knee action, especially on hard roads, predispose to this disease of the feet.

Symptoms.—Ordinarily a corn induces sufficient pain to cause lameness. It may be intense, as in suppurative corn, or it may be but a slight soreness, such as that which accompanies dry corn. It is by no means unusual in chronic corns to see old horses apparently so accustomed to the slight pain that they suffer as not to limp at all. But they are generally restless. They paw their bedding behind them at night and often refuse to lie down for a long rest. The lameness caused by this disease, however, can hardly be said to be characteristic, for the reason that it varies greatly in intensity; but the

position of the leg while the animal is at rest is generally the same in all cases. The foot is so advanced that it is relieved of all weight, and the fetlock is flexed until all pressure by the contents of the hoof is removed from the heels. In suppurative corn the lameness subsides or entirely disappears as soon as the abscess opens. When the injured tissues are much inflamed, as may occur in severe and recent cases, the heel of the affected side, or even the whole foot, is hot and tender on pressure. In dry corns and in most chronic cases all evidences of local fever are often lacking. It is in these cases that the animal goes well when newly shod, for the smith cuts away the sole over the seat of injury until all pressure by the shoe is removed and lowers the heels so that concussion is reduced to a minimum.

If a corn is suspected, the foot should be examined for increased sensibility of the inside heel. Tapping the heel of the shoe with a hammer and grasping the wall and bar between the jaws of pincers with moderate pressure will cause more or less flinching if the disease is present. For further evidence the shoe is removed and the heel cut away with the drawing knife. As the horn is pared out, not only the sole in the angle is found discolored, but in many instances the insensible laminae of the bar and wall adjacent are also stained with the escaped blood. In moist and suppurative corns this discoloration is less marked than in dry corn and even may be entirely lacking. In these cases the horn is soft, often white, and stringy or mealy, as seen in pumiced sole resulting from founder. When the whole thickness of the sole is discolored and the horn dry and brittle, generally the corn is an old one and the exciting cause has existed continuously. A moist corn differs from the dry one in that the injury is more severe. The parts affected are more or less inflamed, and the horn of the sole in the angle is undermined by a citron-colored fluid, which often permeates the injured sole and laminae, causing the horn to become somewhat spongy.

A suppurative corn differs from others in that the inflammation ends in suppuration. The pus collects at the point of injury and finally escapes by working its way between the sensitive and insensible laminae to the top of the hoof, where an opening is made between the wall and coronary band at or near the heels. This is the most serious form of corns, for the reason that it may induce gangrene of the plantar cushion, cartilaginous quittor, or caries of the coffin bone.

Treatment.—Since a diversity of opinion exists as to what measures must be adopted for the cure of corns, the author will advise the use of those that he has found to be most efficient.

As in all other troubles, the cause must be discovered, if possible, and removed. In most cases the shoeing is at fault. Although sudden changes in the method of shoeing are not advisable, all errors, either in the preparation of the foot, in the construction of the shoe,

or in its application, may properly be corrected at any time. Circumstances may at times make it imperative that shoes be worn that are not free from objections, as, for instance, the shoe with a high calk; but in such cases the injuries likely to result from the use of calks are less serious than those that are sure to happen if no calks are used.

For a sound foot perfectly formed, a flat shoe, with heels less thick than the toe, and that rests evenly on the wall proper, is the best. In flat feet it is often necessary to concave the shoe as much as possible on the upper surface, so that the sole may not be pressed upon. If the heels are very low, the heels of the shoe may be made thicker. If the foot is very broad and the wall light toward the heels, a bar shoe resting upon the frog will aid in preventing excessive tension on the soft tissues when the foot receives the weight of the body. A piece of leather placed between the foot and shoe serves largely to destroy concussion, and its use is absolutely necessary on some animals to enable them to work.

Last among the preventive measures are those that maintain the suppleness of the hoof. The dead horn on the surface of the sole not only retains moisture for a long time but protects the living horn beneath from the effects of evaporation; for this reason the sole should be pared as little as possible. Stuffing the feet with flaxseed meal, wet clay, or other like substances, or damp dirt floors or damp bedding of tanbark or greasy hoof ointments are all means that may be used to keep the feet from becoming too dry and hard.

As to the curative measures that are to be adopted, much depends on the extent of the injury. If the case is one of chronic dry corn with but slight lameness, the foot should be poulticed for a day or two and the discolored horn pared out, care being taken not to injure the soft tissues. The heel on the affected side is to be lowered until all pressure is removed and, if it is necessary to use the animal, the foot must be shod with a bar shoe or with one having stiff heels. Care must be taken to reset the shoe before the foot has grown too long, or the shoe will no longer rest on the wall but on the sole and bar.

Moist corns should be cut out. If there is inflammation, cold baths and poultices should be used. When the horn is well softened and the fever allayed, pare out the diseased horn, lightly cauterize the soft tissues beneath, and poultice the foot for 2 to 3 days. When the granulations are red, dress the wound with oakum balls saturated in an antiseptic solution and apply a roller bandage. Change the dressing every 2 or 3 days until a firm, healthy layer of new horn covers the wound, when the shoe may be put on, as in dry corn, and the animal returned to work.

In suppurative corns the loosened horn must be removed so that the pus may freely escape. If the pus has worked a passage to the coronary band and escapes from an opening between the band and hoof, an opening must be made on the sole, and cold astringent antiseptic baths are to be used for a day or two. When the discharge becomes healthy, the fistulous tracts may be injected daily with an antiseptic solution, and the foot dressed as after an operation for moist corns. When complications arise, the treatment must be varied to meet the conditions. If gangrene of the lateral cartilage takes place it must be treated as directed under the head of cartilaginous quittor; if the velvety tissue is gangrenous, it must be cut away; if the coffin bone is necrosed, it must be scraped, and the resulting wounds treated. After any of the operations for corns have been performed, in which the soft tissues have been laid bare, it is best to protect the foot by a sole of soft leather set beneath the shoe when the animal is returned to work. Only in rare instances are the complications of corns so serious as to destroy the life or usefulness of the animal. It is the wide, flat foot with low heels and thin wall that is most likely to resist all efforts toward effecting a complete cure.

BRUISE OF THE FROG

When the frog is severely bruised the injury is followed by suppuration beneath the horn and at times by partial gangrene of the plantar cushion.

Causes.—A bruise of the frog generally results from stepping on a rough stone or other hard object. It is more likely to take place when trotting, running, or jumping than when at a slower pace. A stone wedged in the shoe and pressing on the frog or between the sides of the frog and the shoe, if it remains for a time, produces the same results. A cut through the horny frog with some sharp instrument or a punctured wound by a blunt-pointed instrument may also cause suppuration and gangrene of the plantar cushion. Broad, flat feet with low heels and a fleshy frog are most liable to these injuries.

Symptoms.—Lameness, severe in proportion to the extent of the bruise and the consequent suppuration, is always an early symptom. When the animal moves, the toe only is placed to the ground or the foot is carried and the animal hobbles along on three legs. When the horse is at rest, the foot is set forward with the toe on the ground and the leg flexed at the fetlock joint. As soon as the pus finds its way to the surface the lameness improves. If the frog is examined early the injured spot may usually be found; later, if no opening exists, the pus may be discovered working its way toward the heels. The horn is loosened from the deeper tissues, and, if pared through, a thin, yellow, watery, and offensive pus escapes. In other cases a

ragged opening is found in the frog, leading down to a mass of dead, sloughing tissues, which are pale green in color if gangrene of the plantar cushion has set in. In rare cases the coffin bone may be involved in the injury and a small portion of it may become carious.

Treatment.—If the injury is seen at once, the foot should be placed in a bath of cold water to prevent suppuration. If suppuration has already set in, the horn of the frog, and of the bars and branches of the sole, if necessary, is to be pared thin so that all possible pressure may be removed, and the foot poulticed. When the pus has loosened the horn, all the detached portions are to be cut away. If the pus is discharging from an opening near the hair, the whole frog, or one-half of it, will generally be found separated from the plantar cushion and is to be removed with the knife. After a few days the gangrenous portion of the cushion will slough off from the effects of the poultice. Under rare circumstances only should the dead parts be removed by surgical interference. When the slough is all detached the remaining wound is to be treated with simple stimulating antiseptic dressings, oakum balls, and bandages as directed in punctured wounds. When the lameness has subsided and a thin layer of new horn has covered the exposed parts, the foot may be shod. Cover the frog with a thick pad of oakum, held in place by pieces of tin lifted to slide under the shoe, and return the animal to slow work. If caries of the coffin bone, etc., follows the injury the treatment recommended for these complications in punctured wounds of the foot must be resorted to.

PUNCTURED WOUNDS OF THE FOOT

Of all the injuries to which the foot of the horse is liable, none are more common than punctured wounds, and none are more serious than these may be when involving the more important organs within the hoof. A nail is the most common instrument by which the injury is inflicted, yet wounds may result from glass, wire, knives, sharp pieces of rock, and other objects.

A wound of the foot is more serious when made by a blunt-pointed instrument than when the point is sharp, and the nearer the injury is to the center of the foot the more likely are disastrous results to follow. Wounds in the heel and in the posterior parts of the frog are attended with little danger, unless they are so deep as to injure the lateral cartilages, when quittor may follow. Punctured wounds of the anterior parts of the sole are more dangerous, for the reason that the coffin bone may be injured, and the suppuration, even when the wound is not deep, tends to spread and always gives rise to intense suffering. The most serious of the punctured wounds are those in the center of the foot, and those in proportion to their depth,

involving the plantar cushion, plantar aponeurosis, sesamoid sheath, navicular bone, or coffin joint.

Punctured wounds are more likely to be deep in flat or convex feet than in well-made feet, and as a rule, recovery is neither so rapid nor so certain. These wounds are less serious in animals used for heavy draft than in those required to do faster work; for the former may be useful, even if complete recovery is not effected. Lastly, punctured wounds of the forefeet are more serious than of the hind feet, for the reason that in the former the instrument is likely to enter the foot in a nearly perpendicular line, and, consequently, is more apt to injure the deeper structures of the foot; in the hind foot, the injury is generally near the heels and the wound oblique and less deep.

Symptoms.—A nail or other sharp instrument may penetrate the frog and remain for several days without causing lameness; in fact in many cases of puncture wound of the frog the first evidence of the injury is the finding of the nail or the appearance of an opening where the skin and frog unite, from which more or less pus escapes. Even when the sole is perforated, if the injury is not too deep, no lameness develops until suppuration is established. In all cases of foot lameness, especially if the cause is obscure, the foot should be examined for evidence of injury.

The lameness from punctured wounds accompanied with suppuration, is generally severe, the animal often refusing to use the affected member at all. The pain being lancinating in character, the horse stands with the injured foot at rest or constantly moves it back and forth. In other cases it lies down most of the time with the feet outstretched; the breathing is rapid, the pulse fast, the temperature elevated, and the body covered with patches of sweat.

When the plantar aponeurosis is injured, the pus escapes with difficulty and the wound shows no signs of healing; the whole foot is hot and painful. If the puncture involves the sesamoid sheath, the synovial fluid escapes. At first this fluid is pure, like joint water, but later becomes mixed with the products of suppuration and loses its clear, amber color. Suppuration generally extends up the course of the flexor tendon, an abscess forms in the hollow of the heel, and finally opens somewhere below the fetlock joint. The whole coronet is more or less swollen, the discharge is profuse and often mixed with blood, yet the suffering is greatly relieved from the moment the abscess opens.

If the puncture reaches the navicular bone the lameness is intense from the beginning; but the only certain way to determine the existence of this complication is by the use of the probe; and unless there is a free escape of synovia it must be used with the greatest care, or the coffin joint may be opened.

If the coffin joint has been penetrated, either by the offending instrument or by the process of suppuration, acute inflammation of the joint follows, accompanied with high fever, loss of appetite, and other symptoms. The ankle and coronet are now greatly swollen, and dropsy of the leg to the knee or hock, or even to the body, often follows. If the process of suppuration continues, small abscesses appear at intervals on different parts of the coronet, the patient rapidly loses flesh and may die from intense suffering and blood poisoning. In other cases the suppuration soon disappears, and recovery is effected by the joint becoming stiff (ankylosis).

When the wound is forward, near the toe, and deep enough to injure the coffin bone, caries always results. The presence of the dead pieces of bone can be determined by the use of the probe; the bone feels rough and gritty. Furthermore, there is no disposition on the part of the wound to heal.

Besides the complications above mentioned, others equally as serious may be met with. The tendons may soften and rupture, the hoof may slough off, quitters develop, or sidebones and ringbones grow. Finally, laminitis of the opposite foot may occur if the animal persists in standing, or lockjaw may cause early death.

Treatment.—As a precautionary measure the early administration of tetanus antitoxin is recommended, particularly in areas where lockjaw is known to have occurred. In all cases the horn around the seat of injury should be thinned down, a free opening made for the escape of pus, and the foot placed in a poultice. If the injury is not serious, recovery takes place in a few days. When the wound is deeper it is better to put the foot into a cold bath or under a stream of cold water, as advised in the treatment for quitter.

If the bone is injured, cold baths of astringent antiseptic solutions may be used until the dead bone is well softened, when it should be removed by an operation. The animal must be cast for this operation. The sole is pared away until the diseased bone is exposed, when all the dead particles are to be removed with a drawing knife, and the wound dressed with 3-percent compound cresol solution or a 5-percent solution of carbolic acid, oakum balls, and a roller bandage.

Wounds of the bone that are made by a blunt-pointed instrument, like the square-pointed cut nail, in which a portion of the surface is driven into the deeper parts of the bone, always progress slowly and should be operated on as soon as the conditions are favorable. Even wounds of the navicular bone, accompanied with caries, may be operated on and the life of the patient saved; but the most skillful surgery is required and only the experienced operator should undertake their treatment.

If there is an escape of pure synovial fluid from a wound of the sole, without injury to the bone, a small pencil of corrosive sublimate

may be introduced to the bottom of the wound and the foot dressed as previously directed.

The other complications are to be treated as directed under their proper headings.

After healing of the wounds has been effected, lameness, with more or less swelling of the coronary region may remain. In such cases, the coronet may be blistered or even fired with the actual cautery and the animal turned on pasture. If the lameness still persists and is not due to a stiff joint, unnerving may be resorted to in many cases with good results. If the joint is ankylosed, no treatment can relieve it, and the animal must either be put to very slow work or kept for breeding purposes only.

PRICK IN SHOEING

This is an injury that should be considered under the head of punctured wounds of the foot. The nails by which the shoe is fastened to the hoof may produce an injury followed by inflammation and suppuration in 2 days, by penetrating the soft tissues directly or by being driven so deep that the inner layers of the horn of the wall are pressed against the soft tissues with such force as to crush them. In either case, unless the injury is at the toe, the animal generally goes lame soon after shoeing, when the first evidence of the trouble may be the discharge of pus at the coronet. If lameness follows soon after the setting of the shoes, without other appreciable cause, each nail should be lightly struck with a hammer, when the one at fault will be detected by the flinching of the animal.

Treatment consists in drawing the nail, and if the soft tissues have been penetrated or suppuration has commenced, the horn must be pared away until the diseased parts are exposed. The foot is now to be poulticed for a day or two, or until the lameness and suppuration have ceased. If the discharge of pus from the coronet is the first evidence of the disease, the offending nail must be found and removed, the horn pared out, and a weak solution of carbolic acid or compound cresol injected at the coronet until the fistulous tract has healed.

CONTRACTED HEELS (HOOFBOUND)

Contracted heels, or hoofbound, is a common disease among horses kept on hard floor in dry stables and in such as are subject to much saddle work. It consists in an atrophy, or shrinking, of the tissues of the foot, whereby the lateral diameter of the heels is diminished. It affects the forefeet principally but occasionally the hind feet, where it is of less importance, for the reason that the hind foot first strikes the ground with the toe, and consequently less expansion of the heels is necessary than in the forefeet, where the weight is first received on

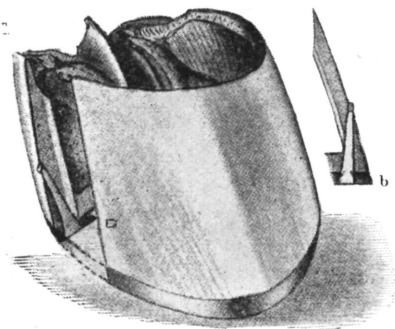
the heels. Any interference with the expansibility of this part of the foot interferes with locomotion and ultimately gives rise to lameness. Usually only one foot is affected at a time, but when both are diseased the change is greater in one than in the other. Occasionally only one heel, and that the inner one, is contracted; in these cases there is less likelihood to be lameness and permanent impairment of the animal's usefulness. According to the opinion of some of the French veterinarians, hoofbound should be divided into two classes—total contraction, in which the whole foot is shrunken in size, and contraction of the heels, when the trouble extends only from the quarters backward (pl. XXXV, figs. 4 and 7).

Causes.—Animals raised in wet or marshy districts, when taken to towns and kept on dry floors, are likely to have contracted heels, not only because the horn becomes dry, but also because fever of the feet and wasting away of the soft tissues result from the change. Another common cause of contracted heels is faulty shoeing, such as rasping the wall, cutting away the frog, heels, and bars; high calks and the use of nails too near the heels. Contracted heels may result from other diseases of the foot; for instance, it often accompanies thrush, sidebones, ringbones, canker, navicular disease, corns, sprains of the flexor tendons and of the sesamoid and suspensory ligaments, and from excessive knuckling of the fetlock joint.

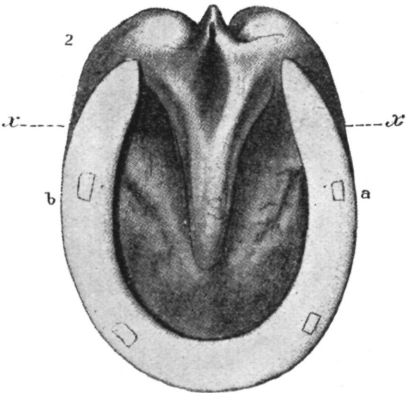
Symptoms.—In contraction of the heels the foot has lost its circular shape, and the walls from the quarters backward approach to a straight line. The ground surface of the foot is now smaller than the coronary circumference; the frog is pinched between the enclosing heels, is much shrunken, and at times is affected with thrush. The sole is more concave than natural, the heels are higher, and the bars are long and nearly perpendicular. The whole hoof is dry and so hard that it can scarcely be cut; the parts toward the heels are scaly and often ridged like the horns of a ram. Fissures, more or less deep, may be seen at the quarters and heels following the direction of the horn fibers (pl. XXXVI, fig. 10). When the disease is well advanced lameness is present, whereas in the earlier stages only an uneasiness is evinced by frequent shifting of the affected foot. Stumbling is common, especially on hard or rough roads. In most cases the animal comes out of the stable stiff and inclined to walk on the toe, but after exercise it may travel freely again. It wears its shoes off at the toe in a short time, no matter whether it works or remains in the stable. In long-standing cases if the shoe is removed and the foot pared, a dry, mealy horn will be found where the sole and wall unite, extending upward in a narrow line toward the quarters.

Treatment.—First of all, preventive measures must be considered. The feet are to be kept moist and the horn from drying out by the use of damp sawdust or other bedding; by occasional poultices, and

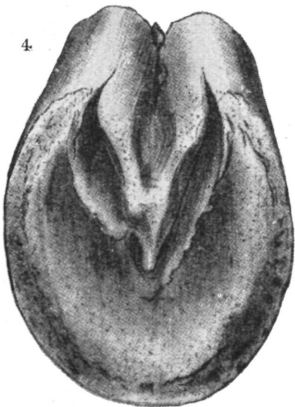
1, 2 and 3, *Sound foot of two year old.*



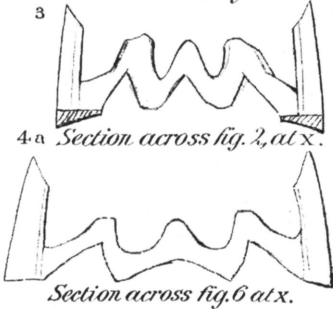
*a, Nail properly driven.
b, Nail improperly driven.*



Sound foot of two year old.



Contracted foot.

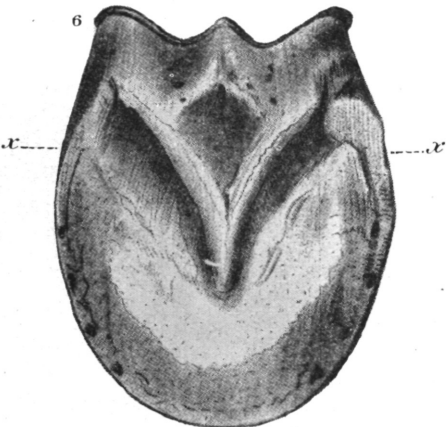


Section across fig. 2, at x.

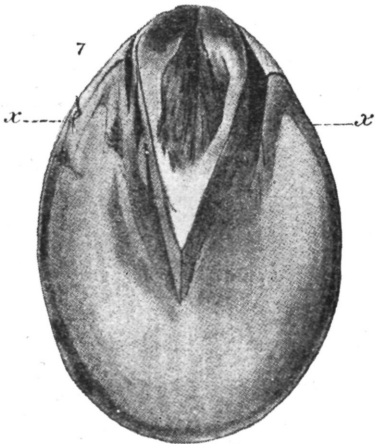
Section across fig. 6 at x.



Section across fig. 7 at x.

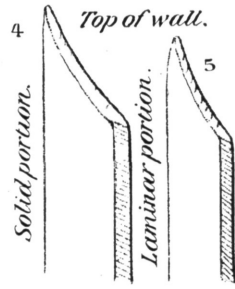
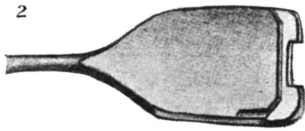
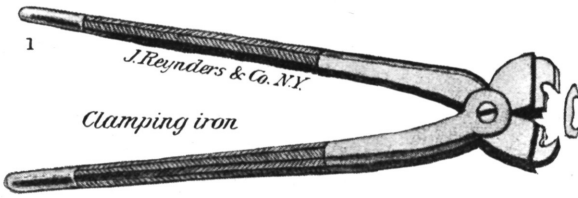


Sound but flat foot.

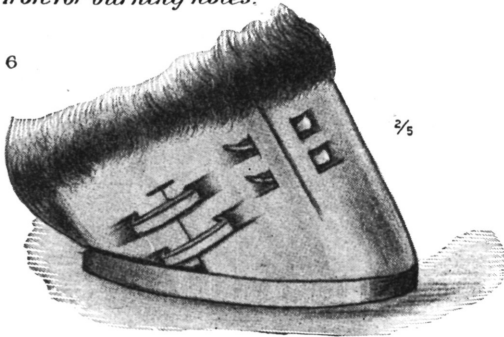


Badly contracted foot.

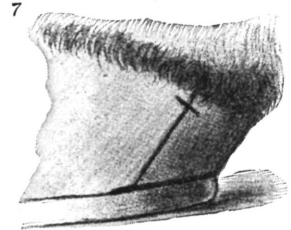
Haines, del.



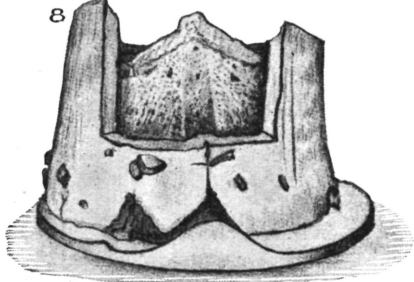
Actual thickness of walls of hoof.



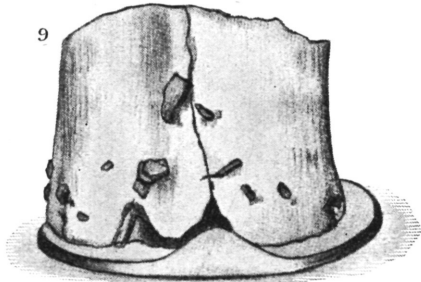
The clamp and nail remedies applied.



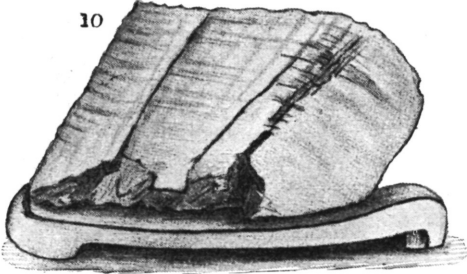
Quarter-crack with cross cut.



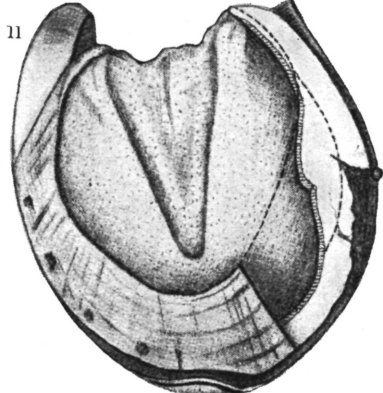
Toe crack. Wall removed to show absorption of coffin bone.



Treated by clamping with nails.



Cracked walls.



One effect of Quarter-Crack.

greasy hoof ointments to the sole and walls of the feet. The wall of the foot should be spared from the abuse of the rasp; the frog, heels, and bars are not to be mutilated with the knife, nor should calks be used on the shoe except when absolutely necessary. The shoes should be reset at least once a month to prevent the feet from becoming too long, and daily exercise must be insisted on.

As to curative measures, a diversity of opinion exists. A number of kinds of special shoes have been invented, having for an object the spreading of the heels, and perhaps any of these, if properly used, would eventually effect the desired result. But a serious objection to most of these shoes is that they are expensive and often difficult to make and apply. The following method of treatment is not only attended with good results but is inexpensive, if the loss of the animal's services for a time is not considered. It consists, first, in the use of poultices or baths of cold water until the horn is thoroughly softened. The foot is now prepared for the shoe in the usual way, except that the heels are lowered a little and the frog remains untouched. A shoe, called a "tip," is made by cutting off both branches at the center of the foot and drawing the ends down to an edge. The tapering of the branches should begin at the toe, and the shoe should be of the usual width, with both the upper and lower surfaces flat. This tip is to be fastened on with six or eight small nails, all set well forward, two being in the toe. With a common foot rasp begin at the heels, close to the coronet, and cut away the horn of the wall until only a thin layer covers the soft tissues beneath. Cut forward until the new surface meets the old $2\frac{1}{2}$ or 3 inches from the heel. The same sloping shape is to be observed in cutting downward toward the bottom of the foot, at which point the wall is to retain its normal thickness. The foot is now blistered all round the coronet with Spanish-fly ointment; when this is well set, the animal is to be turned on pasture in a damp field or meadow. Blistering should be repeated in 3 or 4 weeks, and, as a rule, the animal can be returned to work in 2 or 3 months.

The object of the tip is to throw the weight on the frog and heels, which are readily spread after the horn has been cut away on the sides of the wall. The internal structures of the foot at the heels, being relieved of excessive pressure, regain their normal condition if the disease is not of too long standing. Blistering tends to relieve any inflammation that may be present and stimulates a rapid growth of healthy horn, which, in most cases, ultimately forms a wide and normal heel. In old, chronic cases, with a shrunken frog and increased concavity of the sole, accompanied with excessive wasting of all the internal tissues of the foot, satisfactory results are rarely obtained. Still, much relief may be effected by these measures.

When thrush is present as a complication, its cure must be sought by measures directed under that heading. If sidebones, ringbones, navicular disease, contracted tendons, or other diseases have been the cause of contracted heels, treatment will be useless until the cause is removed.

SAND CRACKS

A sand crack is a fissure in the horn of the wall of the foot. These fissures are narrow, and, as a general rule, they follow the direction of the horny fibers. They may occur on any part of the wall, but ordinarily are seen only directly in front, when they are called toe cracks; or on the lateral parts of the walls, when they are known as quarter cracks (pl. XXXVI).

Toe cracks are most common in the hind feet, whereas quarter cracks nearly always affect the forefeet. The inside quarter is more liable to the injury than the outside, for the reason that this quarter is not only the thinner but also during locomotion receives a greater part of the weight of the body. A sand crack may be superficial, involving only the outer parts of the wall, or it may be deep, involving the whole thickness of the wall and the soft tissues beneath.

The toe crack is most likely to be complete—that is, extending from the coronary band to the sole—whereas the quarter crack is nearly always incomplete, at least when of comparatively recent origin. Sand cracks are most serious when they involve the coronary band in the injury. They may be complicated at any time by hemorrhage, inflammation of the laminae, suppuration, gangrene of the lateral cartilage and of the extensor tendon, caries of the coffin bone, or the growth of a horny tumor known as a keraphyllocele.

Causes.—Relative dryness of the horn is the principal predisposing cause of sand cracks. Excessive dryness is perhaps not a more prolific cause of cracks in the horn than alternate changes from damp to dry. It is even claimed that these injuries are more common in animals working on wet roads than those working on roads that are rough and dry; at least these injuries are not common in mountainous countries. Animals used to being on pasture when transferred to stables with hard, dry floors are more liable to quarter cracks than those accustomed to stables. Small feet, with thick, hard hoofs, and feet that are excessively large, are more susceptible to sand cracks than those of better proportion. A predisposition to quarter cracks exists in contracted feet, and in those where the toe turns out or the inside quarter turns under.

Heavy shoes, large nails, and nails set too far back toward the heels, together with such diseases as canker, quittor, grease-heel, and suppurative corns, are occasional predisposing causes of sand cracks.

Fast work on hard roads, jumping, and blows on the coronet, together with calk wounds of the feet, are accidental causes of quarter cracks in particular. Toe cracks are more likely to be caused by heavy pulling on slippery roads and pavements or on steep hills.

Symptoms.—The fissure in the horn is often the only evidence of the disease; even this may be accidentally or purposely hidden from casual view by mud, ointments, tar, wax, putty, gutta-percha, or by the long hairs of the coronet.

Sand cracks sometimes commence on the internal face of the wall, involving its whole thickness except a thin layer on the outer surface. In these cases the existence of the injury may be suspected from a slight depression, which begins near the coronary band and follows the direction of the horny fibers; but the trouble can be positively diagnosed only by paring away the outside layers of horn until the fissure is exposed. In toe cracks the walls of the fissure are in close apposition when the foot receives the weight of the body, but when the foot is raised from the ground the fissure opens. In quarter crack the opposite is true; the fissure closes when the weight is removed from the foot. As a rule, sand cracks begin at the coronary band, and as they become older they not only extend downward, but they also grow deeper. In cases of long standing, particularly in toe cracks, the horn on the borders of the fissure loses its vitality and scales off, sometimes through the greater part of its thickness, leaving behind a rough and irregular channel extending from the coronet to the end of the toe.

In many cases of quarter crack, and in some cases of toe crack as well, if the edges remain close together, with but little motion, the fissure is dry; but in other cases a thin, offensive discharge issues from the crack and the ulcerated soft tissues, or a funguslike growth protrudes from the narrow opening.

When the cracks are deep and the motion of their edges considerable, so that the soft tissues are bruised and pinched with every movement, a constant inflammation of the parts is maintained and the lameness is severe.

Ordinarily the lameness caused by sand crack is slight when the animal walks, but it is greatly aggravated when the horse is made to trot, and the harder the road the worse it limps. Furthermore, the lameness is greater going downhill than up, for the reason that these conditions are favorable to an increased motion in the edges of the fissure. Lastly, more or less hemorrhage accompanies the inception of a sand crack when the whole thickness of the wall is involved. Subsequent hemorrhage may also take place from fast work, jumping, or a misstep.

Treatment.—As far as preventive measures are concerned, little can be done. The suppleness of the horn is to be maintained by the use of

ointments, damp floor, bedding, and similar means. The shoe is to be proportioned to the weight and work of the animal; the nails holding it in place are to be of proper size and not driven too near the heels; sufficient calks and toe pieces must be added to the shoes of horses working on slippery roads; also, jumping and fast driving are to be avoided.

When a fissure has made its appearance, means are to be adopted that will prevent it from growing longer or deeper; this can be done only by arresting all motion in the edges. The best and simplest artificial appliance for holding the borders of a toe crack together is the Vachette clasp. These clasps and the instruments necessary for their application can be obtained from a veterinary supply house. (pl. XXXVI.) These instruments comprise a cautery iron, with which two notches are burned in the wall, one on each side of the crack, and forceps with which the clasps are closed into place in the bottom of the notches and the edges of the fissure brought close together. The clasps, being made of stiff steel wire, are strong enough to prevent all motion in the borders of the crack. Before these clasps are applied the fissure should be thoroughly cleansed and dried, and if the injury is of recent origin the crack may be filled with a putty made of 2 parts of gutta-percha and 1 part of gum ammoniac. The number of clasps to be used should be determined by the length of the crack and the amount of motion to be arrested. Generally the clasps are from one-half to three-quarters of an inch apart. The clasps answer equally as well in quarter crack if the wall is sufficiently thick and not too dry and brittle to withstand the strain.

In the absence of these instruments and clasps a hole may be drilled through the horn across the fissure and the crack closed with a thin nail made of tough iron, neatly clinched at both ends. A plate of steel or brass is sometimes fitted to the parts and fastened on with short screws. Although this appliance may prevent much gaping of the fissure, it does not entirely arrest motion of the edges, for the reason that the plate and screw cannot be rendered immobile.

If, for any reason, the measures above fail or cannot be used, recourse must be had to an operation. The horn is softened by the use of warm baths and poultices, the animal is cast, and the walls of the fissure entirely removed with the knife. The horn removed is in the shape of the letter V, with the base at the coronet. Care must be taken not to injure the coronary band and the laminae. The wound is to be treated with mild stimulant dressings, such as 2-percent compound cresol solution, or a weak solution of carbolic acid, oakum balls, and a roller bandage. After a few days the wound will be covered with a new, white horn, and only the oakum and bandages will be needed. As the new quarter grows out, the lameness disap-

pears, and the animal may be shod with a bar shoe and returned to work.

In all cases of sand crack the growth of horn should be stimulated by cauterizing the coronary band or by the use of blistering agents. In simple quarter crack, recovery will often take place if the coronet is blistered, the foot shod with a tip, and the animal turned on pasture.

The shoe in toe crack should have a clip on each side of the fissure and should be thicker at the toe than at the heels. The foot should be lowered at the heels by paring, and spared at the toe, except directly under the fissure, where it is to be pared away until it sets free from the shoe.

When any of the complications referred to above arise, special measures must be resorted to. The treatment of gangrene of the lateral cartilage and extensor tendon and caries of the coffin bone is the same as that given in the articles on quitters. If the horny tumor, known as keraphyllocele, should develop, it is to be removed by the use of the knife. Since this tumor develops on the inside of the horny box and may involve other important organs of the foot in disease, its removal should be undertaken only by a competent veterinarian.

NAVICULAR DISEASE

Navicular disease is an inflammation of the sesamoid sheath, induced by repeated bruising or laceration, and complicated in many cases by inflammation and caries of the navicular bone. In some instances the disease undoubtedly begins in the bone, and the sesamoid sheath becomes involved subsequently by an extension of the inflammatory process (pl. XXXIV, fig. 5).

The Thoroughbred horse is more commonly affected than any other, yet no class or breed of horses is entirely exempt. The mule, however, rarely suffers from it. For reasons that will appear when considering the causes of the disease, the hind feet are not likely to be affected. Usually only one forefoot is affected with the disease, but if both should be attacked the trouble has become chronic in the first before the second shows signs of the disease.

Causes.—To comprehend fully how navicular disease may be caused, it is necessary to recall the peculiar anatomy of the parts involved in the process and their functions in locomotion.

The forelegs largely support the weight of the body when the animal is at rest, and the faster the animal moves the greater is the shock to the forefeet as the body is thrown forward by the propelling force of the hind legs. This shock could not be withstood by the tissues of the forefeet and legs were it not that it is largely dissipated by the elastic muscles that bind the shoulder to the body, the ease with which the arm closes on the shoulder blade, and the spring of the

fetlock joint. Even these means, however, are not sufficient within themselves to protect the foot from injury; so nature has further supplemented them by placing the coffin joint on the hind part of the coffin bone instead of directly on top of it, whereby a large part of the shock of locomotion is dispersed before it can reach the vertical column represented by the cannon, knee, and arm bones. A still further provision is made by placing a soft, elastic pad—the frog and plantar cushion—at the heels to receive the sesamoid expansion of the flexor tendon as it is forced downward by the pressure of the coronet bone against the navicular. Extraordinary as these means may appear for the prevention of shock, and ample as they are when the animal is at a slow pace or unweighted by rider or load, they fail to relieve the parts completely from concussion and excessive pressure whenever the opposite conditions are present. The result, then, is that the coronet bone forces the navicular hard against the flexor tendon, which, in turn, presses firmly against the navicular as the force of the contracting muscles lifts the tendon into place. It is self-evident, then, that the more rapid the pace and the greater the load, the greater must these contending forces be, and the greater the liability to injury. For the same reason horses with excessive knee action are more likely to suffer from this disease than others, concussion of the foot and intense pressure on the tendon being common among such horses.

Besides the above-mentioned exciting causes there are those which predispose to the disease. Most prominent among these is heredity. However, an inherited predisposition to navicular disease consists not so much in a special susceptibility of the tissues involved in the process as in a fault of conformation that, as is well known, is likely to be transmitted from parent to offspring. The faults of conformation most likely to be followed by the development of navicular disease are an insufficient plantar cushion, a small frog, high heels, excessive knee action, and contracted heels. Finally, the environments of domestication and use, such as dry stables, heavy pulling, bad shoeing or punctured wounds, have their influence in causing this disease.

Symptoms.—In the early stages of navicular disease the symptoms are generally obscure. When the disease begins in inflammation of the navicular bone, the animal while at rest points the affected foot for a time before any lameness is seen. While at work the horse apparently travels as well as ever, but when placed in the stable one foot is set out in front of the other, resting on the toe, with fetlock and knee flexed. After a time, if the case is closely watched, the animal takes a few lame steps while at work, but the lameness disappears as suddenly as it came, and the driver doubts whether the animal was really lame at all. Later, the animal has a lame spell that may last during a greater part of the day, but the next morning

it is gone; it leaves the stable all right but goes lame again during the day. At times the horse has a severe attack of lameness, which may last for a week or more, when a remission takes place and it may be weeks or months before another attack supervenes. Finally, the animal becomes constantly lame, and the more it is used the greater the lameness.

In the lameness from navicular disease the affected leg always takes a short step, and the toe of the foot first strikes the ground; so the shoe is most worn at this point. If the animal is made to move backward, the foot is set down with exceedingly great care, and the weight rests upon the affected leg but a moment. When exercised the horse often stumbles, and if the road is rough it may fall on its knees. If it is lame in both feet the gait is stilty, the shoulders seem stiff, and, if made to work, it sweats profusely from intense pain. Early in the development of the disease a careful examination will reveal some increased heat in the heels and frog, particularly after work; as the disease progresses this becomes more marked, until the whole foot is hot to the touch. At the same time there is an increased sensibility of the foot, for the animal flinches from the percussion of a hammer lightly applied to the frog and heels or from the pressure of the smith's pincers. The frog is generally shrunken, often of a pale-red color, and at times is affected with thrush. If the heels are pared away so that all the weight is received on the frog, or if the same result is attained by the application of a bar shoe, the animal is excessively lame. The muscles of the leg and shoulder shrink away and often tremble as the animal stands at rest. After months of lameness the foot is found to be shrunken in its diameter and apparently lengthened; the horn is dry and brittle and has lost its natural gloss, and circular ridges, developed most toward the heels, cover the upper part of the hoof. When both feet are affected the animal points first one foot and then the other and stands with the hind feet well forward beneath the body, to relieve the forefeet as much as possible from bearing weight. In cases of long standing the wasting of the muscles and the knuckling at the fetlock become so great that the leg cannot be straightened and locomotion can scarcely be performed. The disease generally makes a steady progress with no indication of recovery—the remission of symptoms in the earlier stages should not be interpreted as evidence that the process has terminated. The complications usually seen are ringbones, sidebones, thrush, contracted heels, quarter cracks, and fractures of the navicular, coronet, and pastern bones.

Treatment.—Few cases of navicular disease recover. In the early stages the wall of the heels should be rasped away, as directed in the treatment for contracted heels, until the horn is quite thin; the coronet

should be well blistered with a blistering agent, and the animal turned on grass in a damp field or meadow. After 3 or 4 weeks the blistering should be repeated. This treatment is to be continued for 2 or 3 months. Plane shoes are to be put on when the animal is returned to work. In chronic cases the horse should be put to slow, easy work. To relieve the pain, neurotomy may be performed—an operation in which the sense of feeling is destroyed in the foot by cutting out pieces of the nerve at the fetlock. This operation does not cure the disease, and, since it may be attended with serious results, can be advised only in certain favorable cases, to be determined by the veterinarian.

SIDEBONES

A sidebone consists in a transformation of the lateral cartilages found on the wings of the coffin bone into bony matter by the deposition of lime salts. The disease is common, especially in heavy horses used for draft, in cavalry horses, cow ponies, and other saddle horses, and in runners and trotters.

Sidebones are peculiar to the forefeet, yet they occasionally develop in the hind feet, where they are of little importance since they cause no lameness. In many instances sidebones are of slow growth and, being unaccompanied with acute inflammation, they cause no lameness until such time as, by reason of their size, they interfere with the action of the joint (pl. XXXIV, fig. 4).

Causes.—Sidebones often grow in heavy horses without any apparent injury, and their development has been attributed to the over-expansion of the cartilages caused by the great weight of the animal. Blows and other injuries to the cartilages may set up an inflammatory process that ends in the formation of these bony growths. High-heeled shoes, high calks, and long feet may excite the growth of sidebones. They are often seen in connection with contracted heels, ringbones, navicular disease, punctured wounds of the foot, quarter cracks, and occasionally as a sequel to founder.

Symptoms.—In the earlier stages of the disease, if inflammation is present, the only evidence of the trouble is a little fever over the seat of the affected cartilage and a slight lameness. In the lameness of sidebones the toe of the foot first strikes the ground and the step is shorter than natural. The animal comes out of the stable stiff and sore, but the gait is more free after exercise.

Since the deposit of bony matter often begins in that part of the cartilage where it is attached to the coffin bone, the diseased process may exist for some time before the bony growth can be seen or felt. Later, however, the cartilage loses its elastic character, and by standing in front of the animal one can see a prominence of the coronary region at the quarters. Occasionally these bones become so large as to bulge the

hoof outward, and by pressing on the joint they so interfere with locomotion that the animal becomes entirely useless.

Treatment.—As soon as the disease can be diagnosed active treatment should be adopted. Cold-water bandages are to be used for a few days to relieve the fever and soreness.

The improvement consequent on the use of these simple measures often leads to the belief that the animal has recovered; but with a return to work the lameness, fever, and other symptoms reappear. For this reason the use of blistering agents or, better still, the firing iron, should follow the discontinuance of the cold bandages.

But in many instances no treatment will arrest the growth of these bony tumors, and as a palliative measure neurotomy must be resorted to. Generally this operation will so relieve the pain of locomotion that the animal may be used for slow work; but in animals used for fast driving or for saddle purposes, the operation is practically useless. Since a predisposition to develop sidebones may be inherited, animals suffering from this disease should not be used for breeding purposes unless the trouble is known to have originated from an accident.

RINGBONE

A ringbone is the growth of a bony tumor on the ankle. This tumor is, in fact, not the disease but simply the result of an inflammatory action set up in the periosteum and bone tissue proper of the pastern bones (pl. XXXIV, fig. 1). (See Ringbone, under Lameness, Its Cause and Treatment, p. 297.)

Cause.—As with other bone diseases, the underlying cause is faulty nutrition with special reference to a calcium phosphorus unbalance. Blows, sprains, overwork of the young, undeveloped animals, fast work on hard roads, and jumping are among the principal accessory causes of ringbone. Horses most disposed to this disease are those with short, upright pasterns, for the reason that the shock of locomotion is but imperfectly dissipated in the forelegs of these animals. Improper shoeing, such as the use of high calks, a too great shortening of the toe and correspondingly high heels, predispose to this disease by increasing the concussion to the feet. (See p. 293, Diseases of Bones.)

Symptoms.—The first symptom of an actively developed ringbone is the appearance of a lameness more or less acute. If the bony tumor forms on the side or upper parts of the large pastern, its growth is generally unattended with acute inflammatory action and consequently produces no lameness or evident fever. These are called "false" ringbones. But when the tumors form on the whole circumference of the ankle, or simply in front under the extensor tendon, or behind under the flexor tendons, or if they involve the joints between the two pastern bones or between the small pastern and the coffin

bone, the lameness is always severe. These constitute the true ringbone. Besides lameness, the ankle of the affected leg presents more or less heat, and in many instances a rather firm, though limited, swelling of the deeper tissues over the seat of the inflammatory process. The lameness of ringbone is characteristic in that the heel is first placed on the ground when the disease is in a foreleg, and the ankle is kept as rigid as possible. In the hind leg, however, the toe strikes the ground first, when the ringbone is high on the ankle, just as in health, but the ankle is maintained in a rigid position. If the bony growth is under the front tendon of the hind leg, or if it involves the coffin joint, the heel is brought to the ground first. In the early stages of the disease it is not always easy to diagnose ringbone, but when the deposits have reached some size they can be felt and seen as well.

The importance of a ringbone depends on its seat and often on its size. If it interferes with the joints or with the tendons it may cause an incurable lameness, even though small. If it is on the sides of the large pastern, the lameness generally disappears as soon as the tumor has reached its growth and the inflammation subsides. Even when the pastern joint is involved, if complete ankylosis results, the animal may recover from the lameness with simply an imperfect action of the foot remaining, due to the stiff joint.

Treatment.—Before the bony growth has commenced, the inflammatory process may be cut short by the use of cold baths and wet bandages, followed by one or more blisters. If the bony deposits have begun, the firing iron may be used. Even when the tumors are large and the pastern joint involved, firing often hastens the process of ankylosis and should always be tried.

When the lower joint is involved, or if the tumor interferes with the action of the tendons, recovery is not to be expected. In many of these latter cases, however, the animal may be made serviceable by proper shoeing. If the animal walks with the toe on the ground, the foot should be shod with a high-heeled shoe and a short toe. On the other hand, if it walks on the heel, a thick-toed and thin-heeled shoe must be worn.

Prevention and treatment should be directed primarily to correcting any mineral deficiency or unbalance in the diet. (See p. 293, Diseases of Bones.)

Since ringbone is considered to be one of the hereditary diseases, no animal suffering from this trouble should ever be used for breeding purposes.

LAMINITIS (FOUNDER)

Laminitis is a simple inflammation of the sensitive laminae of the feet, characterized by the general phenomena attending inflamma-

tion of the skin and mucous membranes, producing no constitutional disturbances except those dependent on the local disease, and having a strong tendency, in severe cases, to destructive disorganization of the tissues affected. The causes of laminitis are as wide and variable as in any of the local inflammations, and may be divided into two classes—the predisposing and the exciting.

Predisposing causes.—It does not appear that any particular construction of the foot or any special breed of horses is predisposed to this disease, nor is it in any way hereditary; therefore, although a predisposition to the disease may easily be cultivated, it does not originate without an exciting cause. Like most other tissues, a predisposition to inflammation may be induced in the sensitive laminae by any cause that lessens their power to withstand work. It exists to an extent in those animals unaccustomed to work, particularly if they are plethoric, and in all that have been previous subjects of the disease, for the same rule holds good here as in many other diseases—that one attack impairs the functional activity of the affected tissues and renders them more susceptible to subsequent inflammation. Unusual excitement by causing an excessive blood supply, bad shoeing, careless paring of the feet by removing the sole support, and high calkings without corresponding toe pieces are among these causes.

Exciting causes.—The exciting causes of laminitis are many and varied. The most common are concussion, overexertion, exhaustion, rapid changes of temperature, ingestion of certain feeds, purgatives, and metastasis.

(1) Concussion produces this disease by local overstimulation. The excessive excitement is followed by an almost complete exhaustion of the functional activity of the laminated tissues. The exhaustion is followed by congestion and eventually by inflammation. But congestion here, as in all other tissues, is not necessarily followed by inflammation; for, although the principal symptoms of true laminitis are present, the congestion may be relieved before the processes of inflammation are fully established. This is the condition in the many so-called cases of laminitis that recover in 24 to 48 hours. They should be called congestion of the laminae.

Laminitis from concussion is common in trotting horses that are raced when not in condition, especially if they carry the obnoxious toe weights, and in horses put to work on city pavements to which they are unaccustomed. Concussion from long drives on dirt roads is at times productive of the same results, notably when the weather is extremely warm, or at least when the relative change of temperature is great. But the resulting exhaustion in this case is an exciting cause, as well as the long-continued concussion. This combination of causes also produces the disease at times in hunters, for the weight

of the rider increases the demands made on the function of these tissues, and their powers are the sooner exhausted.

(2) Overexertion, as heavy pulling or rapid work, even when there is no immoderate concussion, occasionally results in this disease. Here also exhaustion is a conjunctive cause, for overexertion cannot be long continued without exhaustion.

(3) Exhaustion is nearly as common a source of laminitis as is concussion, for when the physical strength is impaired, even though temporarily, some part of the body is rendered more vulnerable to disease than others. This is the cause of those cases of laminitis that follow a hard day's work, in which at no time has there been overexertion or immoderate concussion.

The tendency to laminitis in horses on sea voyages results from the continual constrained position the animal maintains on account of the rocking motion of the vessel.

If one foot has been blistered, or if one leg is incapacitated from any cause, the opposite leg, doing double duty, soon becomes exhausted, and congestion, followed by inflammation, results. When one foot only becomes laminitic, the corresponding leg usually becomes so at a later date, not always because of sympathy, but because one foot had to do the work of two.

(4) Rapid changes of temperature act as an exciting cause of laminitis by interfering with the normal blood supply.

The change of temperature may be induced by drinking large quantities of cold water while in an overheated condition. The internal heat is rapidly reduced, the neighboring tissues and blood vessels constrained, and the blood supply to these organs greatly diminished, whereas the quantity sent to the surface is correspondingly increased. True, in many cases sufficient labor has not been performed to impair the powers of the laminae, but laminitis is more readily induced than congestion or inflammation of the skin or other surface organs, because the laminae cannot relieve themselves of threatened congestion by the general safety valve of perspiration. A cold wind or relatively cold air allowed to play on the body when heated and wet with sweat has virtually the same result, for it arrests evaporation and rapidly cools the external surface, thereby causing an excess of blood to such organs and tissues as are protected from this outside influence. In many instances some of the internal organs, as the lungs, are involved if the previous work has been rapid and their functional activity impaired; but in numerous other instances the feet are affected, for the following two reasons: First, the tissues of these parts have been greatly excited and are already receiving as much blood as they can accommodate consistently with health; second, even though these tissues are classed with those of the surface, their protection from atmospheric influences by means of the thick box of horn

incasing them renders them in this respect equivalent to internal organs.

A more limited local action of cold may excite this disease—for instance, by driving an animal through water or washing the feet and legs while the animal is warm or just in from work. Here a marked reaction takes place in the surface tissues of the legs, and passive congestion of the foot results from an interference with the return flow of blood that is being sent to these organs in excess. These are more likely to be simple cases of congestion, soon to recover, yet they may become true cases of laminitis.

(5) Why certain kinds of grain cause laminitis does not seem to be clearly understood. Certainly they possess no specific action on the laminae, for all animals are not alike affected; neither do they always produce these results in the same animal. Some of these feeds cause a strong tendency to indigestion, and the consequent irritation of the alimentary canal may be so great as to warrant the belief that the laminae are affected through sympathy. In other instances there is no apparent interference with digestion nor evidence of any irritation of the mucous membranes, yet the disease is in some manner dependent on the feed for its inception. Barley, wheat, and sometimes corn are the grains most likely to cause this disease. With some horses there appears to be a particular susceptibility to this influence of corn, and the use of this grain is followed by inflammation of the feet, lasting from a few days to 2 weeks. In these animals, to all appearances healthy, the corn neither induces colic, indigestion, nor purging, and apparently no irritation whatever of the alimentary canal.

(6) Fortunately purgative medicines rarely cause inflammation of the laminae. That it is, then, the result of sympathetic action is very likely, for when there is no derangement of the alimentary canal a dose of cathartic medicine will at times bring on severe laminitis.

(7) Almost all the older authorities were agreed that metastatic laminitis is a reality. In the opinion of the author metastatic laminitis is nothing more nor less than concurrent laminitis and presents little in any way peculiar outside the imperfectly understood exciting cause. The practitioner who allows the acute symptoms of laminitis to mislead him, simply because their severity has overshadowed those of the primary disease, may lose his case through unguarded subsequent treatment. This form of laminitis is by no means commonly met with. It may be found in conjunction with pneumonia, inflammation of the bowels and eyes, and sometimes with bronchitis.

Symptoms.—Laminitis is characterized by a congregation of symptoms so well marked as scarcely to be misinterpreted by the most casual observer. They are nearly constant in their manifestations, modified by the number of feet affected, the cause of the disease, the previous condition of the animal, and the various other influences that

to some extent operate in all diseases. They may be divided into general symptoms, which are concomitants of all cases of the disease, subject to variations in degree only, and special symptoms, or those that serve to determine the feet affected and the complications that may arise.

General symptoms.—Usually, the first symptom is interference with locomotion. Occasionally the other symptoms occur first. As the lameness develops the pulse becomes accelerated, full, hard, and strikes the finger strongly; the temperature soon rises several degrees above the normal, reaching sometimes 106° F., generally ranging between 102.5° and 105° . The respirations are rapid and panting in character, the nostrils widely dilated, and the mucous membranes highly congested. The facial expression is anxious and indicative of acute suffering, and the body is more or less covered with sweat. At first there may be a tendency to diarrhea, or it may appear later as the result of the medicines used. The urine is highly colored, scant in quantity, and of increased specific gravity, owing to the water being eliminated by the skin instead of the kidneys. The appetite is impaired, sometimes entirely lost, but thirst is greatly increased. The affected feet are hot and dry, and as much as possible are relieved from bearing weight. Rapping them with a hammer or compelling the animal to stand on one affected member causes intense pain. The artery at the fetlock throbs beneath the finger.

Special symptoms.—Liability to affection varies in the different feet according to the exciting cause. Any one or more of the feet may become affected by this disease, although it appears more often in the forefeet than in the hind ones. This is due to the difference of the function in that the forefeet are the bases of the columns of support, receiving nearly all the body weight during progression and consequently most of the concussion, whereas the hind feet become simply the fulcra of the levers of progression and are almost exempt from concussion.

One foot.—Injuries and excessive functional performance are the causes of the disease in only one foot. The general symptoms, as a rule, are not severe, there being often no loss of appetite and no unusual thirst, and the pulse, temperature, and respiration remain about normal. Early in the disease, the weight of the body is thrown on the opposite foot, and the affected one is extended, repeatedly raised from the floor, and then carefully replaced. When made to move forward, the lame foot is either carried in the air while progression is accomplished by hopping with the healthy one, or the heel of the first is placed upon the ground and receives little weight while the sound leg is quickly advanced. Progression in a straight line is more easy than turning toward the lame side.

Both forefeet.—When both forefeet are affected the symptoms are well marked. The lameness is excessive and the animal almost immovable. When the animal is standing, the head hangs low down or rests on the manger as a means of support and to relieve the feet; the forefeet are well extended so that the weight is thrown on the heels, where the tissues are least sensitive, least inflamed, and most capable of relief by free effusion. The hind feet are brought forward beneath the body to receive as much weight as possible, thereby relieving the diseased ones. If progression is attempted, which rarely happens voluntarily during the first 3 or 4 days, it is accomplished at first with great pain and lameness, which usually subsides to an extent after a few minutes' exercise. During this exercise, if the animal steps on a small stone or other hard substance, it stumbles painfully and is excessively lame in the affected leg for a number of steps, owing to the acute pain that pressure on the sole causes in the tissues beneath. The manner of the progression is pathognomonic of the complaint. Sometimes the affected feet are simultaneously raised from the ground (the hind ones sustaining the weight), then advanced a short distance and carefully replaced; at almost the same moment the hind ones are quickly shuffled forward near the center of gravitation.

In other instances one foot at a time is advanced and placed with the heel upon the ground in the same careful manner, all causes of concussion being carefully avoided. When an attempt is made to back the animal, it remains almost stationary, simply swaying the body backward on the haunches and elevating the toes of the diseased feet as they rest on their heels. In attempting to turn either to the right or left, the animal allows its head to be drawn to one side to its full extent before moving, then makes its hind feet the axis around which the forward ones describe a shuffling circle.

In most cases of laminitis in the forefeet, the animal persists in standing until it is nearly recovered. In other cases it as persistently lies, standing only when necessary and then for as short a time as possible. If the animal once lies down, the relief experienced causes it to do it again; consequently, the animal is down a greater part of the time. But this is not true of all cases; sometimes the horse will do it once and then cautiously guard against a repetition. Even when the animal is forced to lie down, it often gets upon its feet at the first opportunity, doggedly remaining there until again laid on its side. There is no satisfactory explanation as to why the animal refuses to lie down, since, theoretically, this is the more comfortable position.

The most favored position of the animal when down is on the broadside, with the feet and legs extended. While in this position the general symptoms greatly subside; the respirations and pulse become almost normal; the temperature falls and the perspiration

dries. It is with difficulty that the animal is made to rise. When it attempts to do so it gets up rapidly and "all of a heap," as it were, shifting quickly from one foot to the other until they become accustomed to the weight thrown on them. Occasionally, a horse affected with this disease will get up like a cow, rising on the hind feet first. Although enforced exercise relieves the soreness to some extent, it is but temporary, for after a few minutes' rest it returns with all its former severity.

Both hind feet.—When only both hind feet are affected, they are while standing, maintained in the same position as when only the fore ones are affected, but with an entirely different object in view. Instead of being there to receive weight, they are so advanced that the heels only may receive what little weight is necessarily imposed on them; the forefeet at the same time are placed well back beneath the body, where they become the main supports; the animal standing, as one author describes it, "all of a heap."

Progression is even more difficult now than when the disease is confined to the forefeet. These feet are dubiously advanced a short distance and the hind ones brought forward with a sort of kangaroo hop that results in an apparent loss of equilibrium that the animal is a few moments in regaining. The degree of suffering seems more severe than when the disease affects the forefeet only. The standing position is not often maintained, the patient seeking relief by lying down. This fact is easily understood by observing the cramped and unnatural position assumed while standing, which, if it were maintained for any considerable length of time, would, no doubt, excite the disease in the forefeet.

All four feet.—Laminitis of all four feet is uncommon, and the position assumed is nearly normal. All the feet are slightly advanced, and first one, then another, momentarily is raised from the ground and carefully replaced, this action being kept up almost continually during the time the animal remains standing. The suffering is acute, the appetite lost, and, although the patient lies most of the time, the temperature remains too high. The pulse and respirations are greatly accelerated, the body covered with sweat, and bed sores occur.

Course.—The course that laminitis takes varies greatly in different cases, being influenced more or less by the exciting cause, the animal's previous condition, the acuteness of the attack, and the subsequent treatment. The first symptoms rarely occur while the animal is at work, although the gait is occasionally impaired by stumbling, the body covered with a profuse sweat, and the respirations become blowing in character as premonitions of the oncoming disease; but, as a rule, nothing unusual is noted until the animal has stood for some time after coming in from work, when, in attempting to move it, it is found to be very stiff. Like all congestions, the early symptoms

usually develop rapidly; yet this is not always the case, for often there appears to be no well-defined period of congestion, the disease seemingly commencing at a point and gradually spreading until a large territory is involved in the morbid process.

Simple congestion.—Simple congestion of the laminae, erroneously called laminitis, develops rapidly, the symptoms are but moderately severe, and only 1 to 3 days are required for recovery. There are no structural changes and but a moderate exudate. This is rapidly resorbed, leaving the parts in the same condition as they were previous to the attack. If the congestion has been excessive, a rupture of some of the capillaries will be found, a condition more likely to exist if the animal is made to continue work after a development of symptoms has begun.

True, most of these last-described cases prove to be true laminitis, yet the congestion may pass away and the extravasated blood be absorbed without inflammation sufficient to warrant calling it laminitis. The seat of greatest congestion will always be found in the neighborhood of the toe, because of the increased vascularity of that part, and, although at times it is limited to the podophyllous tissue alone, any or all parts of the keratogenous membrane may be affected by the congestion and followed finally by inflammation.

Acute inflammation.—In the acute form of laminitis the symptoms may all develop rapidly, or it may commence by the appearance of a little soreness of the feet, which in 24 or 48 hours develops into a well-marked case. This peculiarity of development is due to one of two causes. Either the congestion is general, but takes place slowly, or it begins in one or more points and gradually spreads throughout the laminae. These acute cases generally run their course in 1 to 2 weeks. Usually a culmination of the symptoms is reached, if the patient is properly treated, in 3 to 5 days; then evidences of recovery are discernible in favorable cases. The lameness improves, the other symptoms gradually subside, and eventually health is regained. In these cases, a strong tendency to disorganization of a destructive character exists; hence, many recover imperfectly, with marked structural changes permanently remaining.

Subacute inflammation.—Subacute laminitis is most often a termination of the acute form although it may exist independent of or precede an acute attack. It is characterized by the mildness of its symptoms, slow course, and moderate tissue changes. It may be present a long time before any pathological changes result other than those found in the acute form, and when these changes take place they should be viewed rather as complications.

Chronic inflammation.—Chronic laminitis is a term used by many to designate any of the sequelae of the acute and subacute forms of this disease. Chronic inflammation of the laminae is not common but

is most frequent in horses that have long done fast track work. They have "fever in the feet" at all times and are continually sore, both conditions being aggravated by work. Like chronic inflammation of other parts, there is a strong tendency to the development of new connective tissue that by its pressure on the blood vessels, interferes with nutrition. Wasting of the coffin bone and inflammation of its covering with caries are not unusual. The continued fever and impaired function of secretion result in the production of a horn deficient in elasticity, somewhat spongy in character, and inclined to crumble. In some cases of "soreness" in horses used to hard or fast work there is evident weakness of the coats of the vessels, brought on by repeated functional exhaustion. Here slight work brings on congestion, which results in serous effusion and temporary symptoms similar to those of chronic laminitis.

Complications.—Complications concurrent with or supervening upon laminitis are frequent and varied and often depend on causes not fully understood.

Excessive purgation.—This is one of the simplest of these and is not usually attended with dangerous consequences. It rarely occurs unless induced by a purgative, and the excessive action of the medicine is probably due to the fact that the mucous membrane sympathizes with the diseased laminae, is irritable, and readily becomes overexcited. The discharges are thin and watery, sometimes offensively odorous, and occasionally persist in spite of treatment. It may prove disastrous to the animal by the rapid exhaustion that it causes, preventing resolution of the laminitis, and may even cause death.

Septicemia and pyemia.—Septicemia and pyemia are unusual complications and occur only in the most severe cases in which bed sores are present or suppuration of the laminae results. Animals so affected die, as a rule, within 3 days after showing signs of the complication.

Pneumonia.—The so-called metastatic pneumonia needs no special consideration, for in its lesions and symptoms it does not differ from ordinary pneumonia, although it may be overlooked entirely by the practitioner. Examinations of the chest should be made every day to detect the disease at its onset and render proper aid.

Sidebones.—A rapid development of sidebones is one of the complications, or a sequel of laminitis not often met with in practice. Here the inflammatory process extends to the lateral cartilages, with a strong tendency to calcification. The deposition of the lime salts is sometimes very rapid, so that the "bones" are developed in a few weeks; in other instances they are deposited slowly and their growth is not noted until long after the subsidence of the laminitis, so that the exciting cause is not suspected. This change in the cartilages may commence in the very beginning of laminitis, and although the trouble in the laminae is removed in the course of a fortnight the symptoms do

not entirely subside, the animal retains the shuffling gait, the sidebones continue to grow, and the animal usually remains lame. This alteration of the cartilages generally prevents the animal from recovering its natural gait.

The laminitic process occasionally extends to the covering of the coronet bone, or at least concurrent with and subsequent to laminitis the development of "low ringbone" is seen, and it apparently depends on the disease of the laminae for its exciting cause. The impairment of function and consequent symptoms are much less marked here than in sidebones. The coronet remains hot and sensitive and somewhat thickened after the laminitis subsides, and a little lameness is present. This lameness persists, and the deposits of new bone may readily be detected.

Suppuration.—Suppuration of the sensitive membrane is a somewhat common complication, and even when present in its most limited form is always a serious matter; but when it becomes extensive and especially when the suppurative process extends to the periosteum, the results are likely to be fatal. When suppuration occurs the exudation does not appear to be excessive. It is rich in leucocytes and seems to have caused detachment of the sensitive tissues from the horn prior to the formation of pus in some instances; in others the tissues are still attached to the horn, and the suppuration takes place in the deeper tissues.

Limited suppuration may take place in any part of the sensitive tissues of the foot during laminitis and may ultimately be reabsorbed instead of being discharged upon the surface, but generally the process begins in the neighborhood of the toe and spreads backward and upward toward the coronet, finally separating the horn from the coronary band at the quarters. At the same time it spreads over the sole and eventually the entire hoof is loosened and sloughs away, leaving the tissues beneath entirely unprotected. In other instances—and these are generally the cases not considered unusually severe—the suppuration begins at the coronary band. It extends but a short distance into the tissues yet destroys the usefulness of the animal by separating the hoof from the coronary band, on which it depends for support and growth. This form of the suppurative process usually begins in front. It is this part of the coronary band that is always most actively affected with inflammation, and consequently it is here that impairments first occur.

Suppuration of the sensitive sole is more common than of the sensitive laminae and coronary band. It is present in most cases in which there is a dropping of the coffin bone, and in other instances when the effusion at this point is so great as to arrest the production of horn and uncover the sensitive tissues. Except when the result of injury, it begins at the toe and spreads backward, and,

if not relieved by opening the sole, escapes at the heel. Suppuration of the sole is much less serious than in other parts of the foot.

If the acute constitutional symptoms developed from sloughing of the foot do not result in death, a new hoof of very imperfect horn may be developed after a time; but the foot will always be useless for work and unless the animal is to be kept for breeding purposes alone it should be killed. When only the sole sloughs, recovery takes place with proper treatment.

Peditis.—This term has been applied to that serious complication of laminitis in which not only the laminae but the periosteal membrane covering the bone and coffin bone also are subjects of the inflammatory process. In some of these cases of peditis, acute inflammation of the coffin joint also is present, and occasionally suppuration of the joint. A mild form of periostitis, in which the exudation is in the outer layer of the periosteum only, is a more common condition than is recognized generally. Intimate contiguity of structures is the predisposing cause, for the disease either spreads from the original seat or the complication occurs as one of the primary results of the exciting cause. In the severer cases in which the exudate separates the periosteum from the bone, suppuration, gangrene, and superficial necrosis are common results. If infiltration of the bone tissues is rapid the blood supply is cut off by pressure on the vessels and death of the coffin bone follows. Grave constitutional symptoms mark these changes, which soon prove fatal.

In mild cases of periostitis it is by no means easy positively to determine its presence, for there are no special symptoms by which it may be distinguished from laminitis. However, in most acute cases that show no signs of improvement by the fifth to the seventh day, it is safe to suspect periostitis, particularly if the coronets are very hot, the pulse full and hard, and the lameness acute. In the fortunately rare cases in which the bone is affected with inflammation and suppuration, the agony of the animal is intense; it lies down almost continually, never standing for more than a few minutes at a time; suffers from the most careful handling of the affected feet; maintains a rapid pulse and respiration, high temperature, loss of appetite, and great thirst; and continually grows worse. The appearance of suppuration at the top of the hoof in about 2 weeks after the inception of the disease proves the inefficiency of any treatment that may have been used and the hopelessness of the case. These patients die usually between the tenth and twentieth days either from exhaustion or pyemic infection.

Gangrene.—This occurs in the periosteum as the result of excessive detachment from the bone and compression due to excessive exudation. Other parts of the sensitive tissues are subject occasionally to the same fate, and at times large areas will be found dead.

Pumiced sole.—In this condition the horny sole in the neighborhood of the toe readily crumbles away and leaves the sensitive tissues more or less exposed. It is not a complication of laminitis only, for it is seen under other conditions. One writer has described the horny tissue of pumiced sole as “weak, cheesy, or spongy, like macerated horn, or even grumous (thick, clotted).” Crumbling horn, when critically examined, shows almost an entire absence of the cohesive matter that unites the healthy fibers, and the fibers themselves are irregular and granular in appearance. Pumiced sole depends on an impairment of the horn-secreting powers of the sensitive sole or on a separation of the horny from the soft tissues that maintain its vitality.

Punctured wounds of the foot, accompanied with any considerable destruction of the soft tissues, present the same peculiarities of horn in the immediate neighborhood of the injury. Bruises of the sole are followed by this change when the exudation has been excessive and has separated the horn from the living tissues. True, in these cases the soft tissues are rarely laid bare, for the reason that new horn is constantly secreted and replaces that undergoing disintegration.

Laminitis presents three conditions under which pumiced sole may appear: (1) When free exudation separates the horn from the other tissues, or when the process of inflammation arrests the production of horn by impairing or destroying the horn-secreting membrane; (2) when depression of the coffin bone causes pressure on and arrests the formation of horn; and (3) when the elevation of the sole compresses the soft tissues against the pedal bone and induces the same condition.

Pumiced sole, from simple exudation and separation of tissues, is of little importance for the reason given above in connection with bruises; but when suppuration occurs in restricted portions of the foot in conjunction with laminitis, it always lays bare the tissues beneath and temporarily impairs the animal's value. Recovery takes place after a few weeks by the tissues “horning over,” as in injuries attended by the same process. Depression of the coffin bone is not sufficient within itself to cause pumiced sole; for if the relative change in the bone takes place slowly, or if the horn is thin, the sole becomes convex from gradual pressure and the soft tissues adapt themselves to the change without having their function materially impaired. But when the dropping is sudden and the soft tissues are destroyed, the horn rapidly crumbles away and the toe of the bone comes through. In many of these cases the soft tissues remain uncovered for months. When they are eventually covered it is with a thin, slightly adherent horn that stands but little or no wear. The sole being now convex, the diseased tissues bear unusual weight by coming in contact with the ground, and hence these animals are generally incurable cripples.

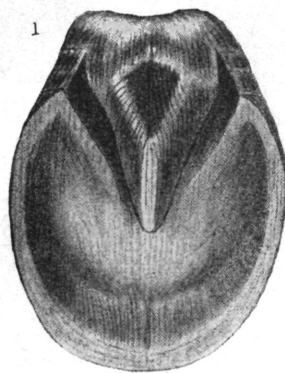
In most cases in which the sole is raised to meet the pedal bone and pumiced sole occurs, it is due not to pressure of the bone from within (for the tissues are capable of adapting themselves to the gradual change) but to impaired vitality of the sensitive tissues from the inflammation and to the constant concussion and pressure applied from without during progression. To this is to be added the paring away of the horn when applying the shoe, thereby keeping the sole at this point too thin.

Turning up of the toe.—In many cases of laminitis that have become chronic, the toe of the foot turns up, the heels are longer than natural, and the hoof near the coronary band is circled with ridges like the horn of a ram. Even in cases in which recovery has taken place, and in other diseases than laminitis, these ridges may be found in the wall of the foot. In such cases, however, the ridges are equally distant from one another all around the foot, whereas in turning up of the toe the ridges are wide apart at the heels and close together in front, as seen in plate XXXVII, figure 4. These ridges are produced by periods of interference with the growth of horn alternating with periods during which a normal or nearly normal growth takes place. When the toe turns up it is because the coronary band in front produces horn very slowly, whereas at the heels it grows much faster, causing marked deformity.

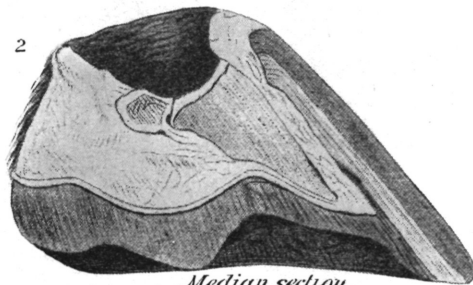
Animals so affected always place the abnormally long heel first upon the ground, not only because the heel is too long, nor as in acute or subacute laminitis to relieve the pain, but for the reason that the toe is too short and lifted away from its natural position. To bring the toe to the ground the leg knuckles at the fetlock joint.

The pain and impairment of function in these cases always result in marked atrophy of the muscles of the forearm and shoulder, and to some extent of the pectorals, and the position of the forelegs advances the shoulder joints so far forward as to cause a sunken appearance of the breast, which is sometimes referred to as "chest founder." The lesions of turning up of the toe are permanent.

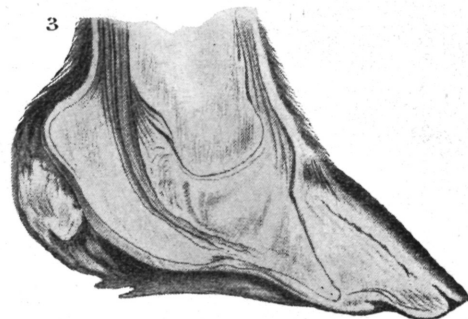
Prevention.—If the disease were dependent on specific causes, or if the stability of the tissues were of a fixed or more nearly determinate quality, some measures might be instituted that would prove generally preventive; but the predisposing causes are common conditions and often cannot be remedied. That which is gentle work in one instance may incite disease in another. That which is good feed today may be disastrous to health tomorrow. Finally, necessary medicinal interference, no matter how judicious, may cause a more serious complaint than that being treated. Notwithstanding these difficulties there are some general rules that will in part prevent the development of an unusual number of cases. First of all, the predisposing causes must be removed when possible; when impossible, unusual care must be



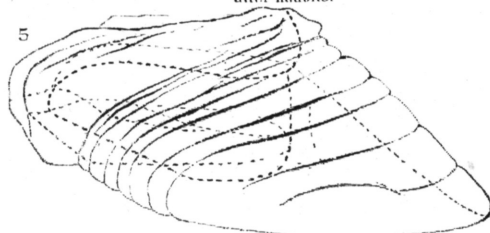
*Foundered foot,
after Haubner.*



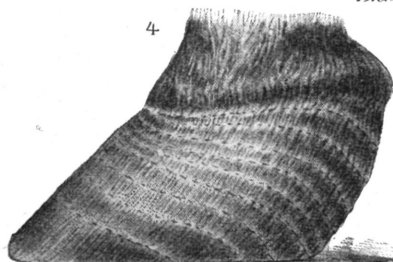
*Median section,
after Haubner.*



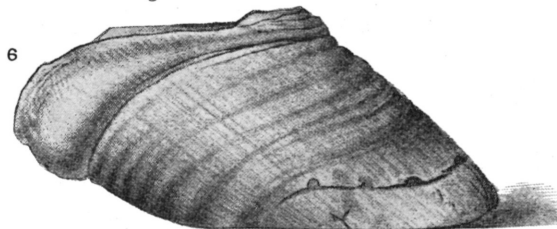
*Median section,
after Percivall.*



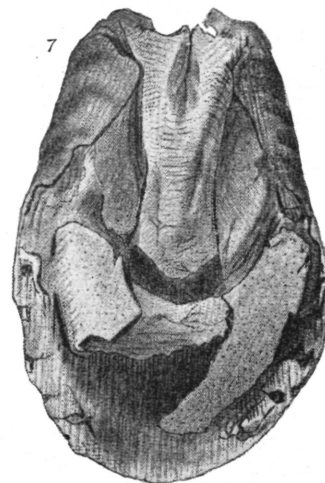
*Skeleton of hoof showing cavity occupied by the foot,
Original.*



*Same foot as shown in fig. 1,
(Original)*



*Same foot as shown in fig. 5,
Original.*



*Bottom of foot shown in fig. 6,
(Original)*

FOUNDERED FEET.

taken not to bring an exciting cause into operation. Under no circumstances should fat animals have hard work. If the weather is warm or the variation of temperature great, all horses should have slow, gentle labor until they become inured to it, the tissues hardened, and their excitability reduced to a minimum. Horses, when taken from the farm and dirt roads to city pavements, should have moderate work; for under these circumstances increased concussion, changed hygienic conditions, and artificial living readily become active causes of the disease. Army horses just out of winter quarters, track horses with insufficient preparation, and farmers' horses put to work in the spring are among the most susceptible classes and must be protected by work that is easy and gradual. If long drives are imperative, the incumbrances must be as light as possible and frequent rests given. This procedure allows the laminae to regain their impaired functional activity and to withstand much more work without danger. Furthermore, it permits early detection of an attack, which renders subsequent medication more effective than if it were begun later.

All animals when resting immediately after work should be protected from cold air or drafts. If they are placed in a stable that is warm and without draft, no covering is necessary; under opposite conditions blankets should be used until the excitement and exhaustion of labor have entirely passed away. It is still better that all animals coming in warm from work be walked slowly until the perspiration has dried and the circulation and respiration are again normal. Animals stopped on the road even for a few moments should always be protected from rapid change of temperature by appropriate clothing. If it can be avoided, horses that are working should never be driven or ridden through water. If unavoidable, they should be cooled off before passing through, and then kept moving until completely dried. The same care is to be practiced with washing the legs in cold water when the animal is just in from work, for occasionally it is the cause of a very acute attack of this disease.

Unusual changes in the manner of applying the shoes should not be hastily made. If a plane shoe has been worn, high heels or toes must not be substituted at once; but the change, if necessary, should gradually be made, so that the different tissues may adapt themselves to the altered conditions. If radical changes are imperative, as is sometimes the case, the work must be so reduced in quantity and quality that it cannot excite the disease.

Laminitis from the effects of purgatives can scarcely be guarded against. The trouble does not seem to depend on the size of the dose, the length of time before purgation begins, or the activity and severity with which the remedy acts. Medicines known to have unusually irritating effects on the alimentary canal should be used only when necessary, and then in moderate doses.

Experience alone will determine which animals are likely to suffer from this disease through the use of feeds. When an attack can be ascribed to any particular feed it should be withheld, or fed in small quantities. Horses that have never been fed corn should receive only a little at a time, mixed with bran, oats, or other feed, until it has been determined that no danger exists. Corn is less safe in warm than in cold weather, and for this reason it should always be fed with caution during spring and summer months.

When an animal is excessively lame in one foot the shoe of the opposite foot should be removed, and cold water frequently applied to the well foot. At the same time, if the animal remains standing, slings should be used. Horses should under no circumstances be overworked; to guard against this, previous work, nature of roads, state of weather, and various other influences must be carefully considered. Watering the animal while it is warm unless the animal is accustomed to it, is likely to result in some disorder, often laminitis.

Treatment.—In simple congestion of the laminae, the body should be warmly clothed and warm drinks administered. The feet should be placed in a warm bath to increase the return flow of blood. In the course of an hour the feet may be changed to cold water and kept there until recovery is completed. If the constitutional symptoms demand it, diuretics should be given. In cases of active congestion the warm footbaths should be omitted and cold ones used from the beginning. Subacute laminitis requires the same treatment, with laxatives if there is constipation, and the addition of low-heeled shoes. The diuretics may need to be continued for some time and their frequency increased. Regarding acute laminitis, what has been called the "American treatment" is simple and efficient. It consists solely in the administration of large doses of a diuretic and the continued application to the feet and ankles of cold water.

Under this treatment the laminitis frequently subsides within a week. These large doses may be continued for a week without danger to the kidneys or any other organs.

The feet should be kept in a tub of water at a temperature of 45° to 50° F. unless the animal is lying down, when swabs are to be used and wet every half hour with the cold water. The water keeps the horn soft and moist and acts directly on the inflamed tissues by reducing the temperature. Cold maintains the vitality and disease-resisting qualities of the soft tissues, tones up the coats of the blood vessels, diminishes the supply of blood, and limits the exudation. Furthermore, it has an anesthetic effect on the diseased tissues and relieves the pain. The use of cathartics is dangerous, for they may excite superpurgation; laxatives may be carefully given. Bleeding, both general and local, should be guarded against. The shoes must be removed early and the soles left unpared.

Paring of the soles presents two objections: (1) Although it may temporarily relieve the pain by relieving pressure, it favors greater exudation, which may more than counterbalance the good effects. (2) It makes the feet tender and subject to bruises when the animal again goes to work. The shoes should be replaced when convalescence sets in and the animal is ready to take exercise. Exercise should never be enforced until the inflammation has subsided; for although it temporarily relieves the pain and soreness it maintains the irritation, increases the exudation, and postpones recovery.

If at the end of the fifth or sixth day prominent symptoms of recovery are not apparent, apply a blistering agent around the coronet and omit the diuretics for about 48 hours. When the blister is well set, the feet may again receive wet swabs. If one blister does not remove the soreness it may be repeated, or the actual cautery applied. The same treatment should be adopted where sidebones form or inflammation of the coronet bone follows. When the sole breaks through, exposing the soft tissues, the feet must be carefully shod with thin heels and thick toes if there is a tendency to walk on the heels, and the sole must be well protected with appropriate dressings and pressure over the exposed parts. When there is turning up of the toe, blistering of the coronet, in front only, sometimes stimulates the growth of horn, but as a rule judicious shoeing is the only treatment that will enable the animal to do light, slow work.

When suppuration of the laminae is profuse, it is well to kill the animal at once, but if the suppuration is limited to a small extent of tissue, especially of the sole, treatment, as in acute cases, may induce recovery and should always be tried.

Every possible precaution should be taken to prevent bed sores if the horse persists in lying down to relieve the pain. Infection from bed sores, once they begin, may cause a general poisoning. Such measures include changing the animal's position and the early application of antiseptic dressings to any wounds of the skin.

Lastly, convalescent cases must not be returned to work too early, or permanent recovery may never be effected.

Diseases of the Skin

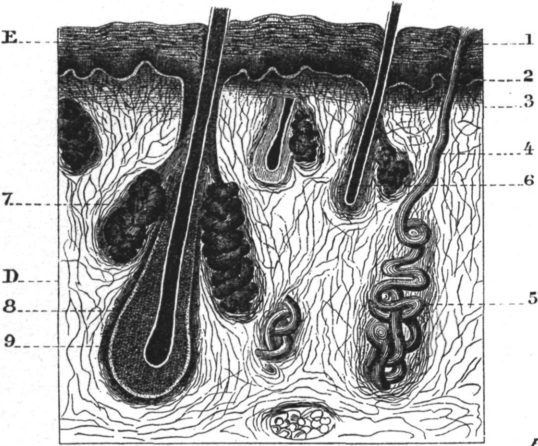
By JAMES LAW, F. R. C. V. S.

[Revised by GILBERT T. CREECH, D. V. S.]

The diseases of the skin are numerous and complex, which may be largely accounted for by the fact that the cutaneous covering is exposed to view at all points, so that shades of difference in inflammatory and other diseased processes are easily seen and distinguished from one another. In the horse the hairy covering serves to some extent to mask the symptoms, and hence the nonprofessional man is tempted to apply the term "mange" to all alike, and it is only a step further to apply the same treatment to all these widely different disorders. Yet even in the hairy quadruped the distinction can be made in a way that cannot be done in disorders of the mucous membrane, which lines the air passages, digestive organs, and the urinary and genital apparatus. Diseased processes, therefore, which in these organs might be difficult or impossible to distinguish from one another, can usually be separated and recognized when appearing in the skin.

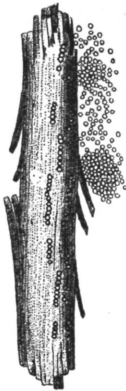
Nor is this differentiation unimportant. The cutaneous covering presents such an extensive surface for the secretion of sebaceous matter, sweat, and other excretory matters, that any extensive disorder in its functions may lead to serious internal disease and death. Again, the intimate nervous sympathy of different points of the skin with particular internal organs renders certain skin disorders causative of internal disease and certain internal diseases causative of affections of the skin. The mere painting of the skin with an impermeable coating of glue is speedily fatal; a cold draft striking on the chest causes inflammation of the lungs or pleura; a skin eruption speedily follows certain disorders of the stomach, the liver, kidneys, or even the lungs; extensive burns of the skin cause organic disturbance and inflammation of the organs may cause in their turn eruptions on the skin. The relations—nervous, secretory, and absorptive—between the skin and internal organs are extensive and varied, and therefore a visible disorder in the skin may point at once and specifically to a particular fault in diet, to an injudicious use of cold water when the system is heated, to a fault in drainage, ventilation, or lighting of the stables, to indigestion, to liver disease, to urinary disorder, or to other causes.

1



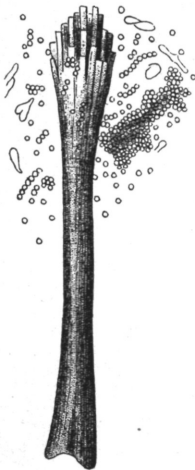
Vertical section through skin.
after Chauveau.

3



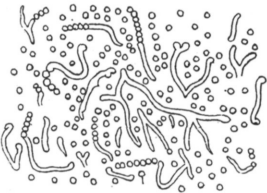
Hair diseased by
Trichophyton tonsurans.
after Mèguin.

2



Hair diseased by
Achorion Schönleini.
after Mèguin.

4



Microsporon Adouinii from
Parasitic Pityriasis in the horse.
after Mèguin.

STRUCTURE OF THE SKIN

The skin consists primarily of two parts: (1) The superficial non-vascular (without blood vessels) layer, the cuticle, or epidermis; and (2) the deep vascular (with blood vessels) layer, the corium, dermis, or true skin (pl. XXXVIII, fig. 1).

The cuticle is made up of cells placed side by side and more or less modified in shape by their mutual compression and by surface evaporation and drying. The superficial stratum consists of the cells dried in the form of scales, which fall off continually and form dandruff. The deep stratum is formed of somewhat rounded cells with large central nuclei; in colored skin this stratum contains numerous pigment granules. These cells have prolongations, or branches, by which they communicate with one another and with the superficial layer of cells in the true skin beneath. Through these prolongations they receive nutrient liquids for their growth and increase and pass on liquids absorbed by the skin into the vessels of the true skin beneath. The living matter in the cells exercises an equally selective power on what they shall take up for their own nourishment and on what they shall admit into the circulation from without. Thus, certain agents, such as iodine and belladonna, are readily admitted, whereas others, such as arsenic, are excluded by the sound, unbroken epidermis. Between the deep and superficial layers of the epidermis there is a thin, translucent layer (*septum lucidum*) consisting of a double stratum of cells, and forming a medium of transition from the deep spheroidal to the superficial scaly cuticle.

The true skin, or dermis, has a framework of interlacing bundles of white and yellow fibers, large and coarse in the deeper layers, and fine in the superficial layers, where they approach the cuticle. Between the fibrous bundles are interspaces that, like the bundles, become finer as they approach the surface, and enclose cells, vessels, nerves, glands, gland ducts, hairs, and in the deeper layers fat.

The superficial layer of the dermis is formed into a series of minute, conical elevations, or papillae, projecting into the deep portion of the cuticle, from which they are separated by a fine transparent membrane. This papillary layer is richly supplied with capillary blood vessels and nerves and is at once the seat of acute sensation and the point from which the nutrient liquid is supplied to the cells of the cuticle above. It is also at this point that the active changes of inflammation are especially concentrated. It is on the surface of the papillary layer that the liquid which raises the cuticle in the form of a blister is thrown out, and it is at this point mainly that pus forms in the ordinary pustule.

The fibrous bundles of the true skin contain plain, muscular fibers, which are not controlled by the will but contract under the influence

of cold and under certain nervous influences, as in some skin diseases and in the chill of a fever, and lead to contraction, tightening, or corrugation of the skin, contributing to produce the condition referred to by the horseman as hidebound. Other minute, muscular filaments are extended from the surface of the dermis to the hair follicle on the side to which the hair is inclined, and under the same stimulating influences produce that erection of the hair known as staring coat. Besides these, the horse's skin is furnished with an expansion of red, voluntary muscle, firmly attached to the fibrous bundles, and by which the animal can dislodge insects and other irritants. This fleshy envelope covers the sides of the trunk and the lower portions of the neck and head, the parts unprotected by the mane and tail, and serves to throw the skin of these parts into puckers, or ridges, in certain irritating skin diseases.

The hairs are cuticular products growing from enlarged papillae lodged in the depth of a follicle or sac, hollowed out in the skin and extending to its deepest layers. The hair follicle is lined by cells of epidermis, which at the bottom are reflected on the papilla and become the root of the hair. The hair itself is formed of the same kind of cells firmly adherent to one another by a tough, intercellular substance, and overlapping each other, like slates on a roof, in a direction toward the free end.

The sebaceous glands are branching tubes ending in follicles or sacs and opening into the hair follicles, lined by a vascular fibrous network representing the dermis, and an internal layer of cells representing the mucous layer of the cuticle. The oily secretion gives gloss to the hair and prevents its becoming dry and brittle, and keeps the skin soft and supple, protecting it at once against undue exhalation of water and undue absorption when immersed in that medium. Besides those connected with the hair follicles there are numerous, isolated, sebaceous glands, opening directly on the surface of the skin, producing a somewhat thicker and more odorous secretion. They are found in large numbers in the folds of the skin, where chafing would be likely to occur if the surface were dry, as on the sheath, scrotum, mammary glands, and inner side of the thigh, around the anus and vulva, in the hollow of the heel, beneath the fine horn of the frog, on the inner side of the elbow, on the lips, nostrils, and eyelids. When closed by dried secretion or otherwise, these glands may become distended to form various-sized swellings on the skin, and when inflamed they may throw out offensive, liquid discharges, as in "grease-heel," or produce red, tender, fungous growths ("grapes").

The sweat glands of the horse, like those of man, are composed of simple tubes, which extend down through the cuticle and dermis in a spiral manner, and are coiled into balls in the deeper layer of the true

skin. In addition to their importance, in throwing offensive waste products out of the system, these glands by cooling the skin tend to cool the entire body through the evaporation of their watery secretion. Their activity is therefore a matter of no small moment, since besides regulating the animal heat and excreting impurities they influence largely the internal organs through the sympathy maintained between them and the skin.

Diseases of the skin may be conveniently divided, according to their most marked features, into—

(1) Those in which congestion and inflammation are the most marked features, varying according to the grade or form into (a) congestion with simple redness, dryness, and heat, but no eruption (erythema); (b) inflammation with red-pointed elevations, but no blisters (papules); (c) inflammation with fine, conical elevations, each surmounted by a minute blister (vesicle); (d) inflammation with a similar eruption but with larger blisters, like half a pea and upwards (bullae); (e) inflammation with a similar eruption, but with a small sac of white, creamy pus on the summit of each elevation (pustules); (f) the formation of pustules implicating the superficial layer of the true skin, a small portion of which dies and is thrown off as a slough, or "core" (boils); (g) the formation of round, nodular, transient swellings in the true skin (tubercles); and (h) the excessive production of scales, or dandruff (scaly or squamous affections).

(2) Diseases in which there are only deranged sensations of itching, heat, tenderness, etc. (neurosis).

(3) Diseased growths, such as warts, calluses, horny growths, or cancer.

(4) Diseases from parasites, animal and vegetable.

(5) Diseases connected with a specific virus or micro-organism, such as horsepox, erysipelas, anthrax, farcy, or cutaneous glanders.

(6) Physical injuries such as wounds, burns, scalds, or freezing.

ERYTHEMA (CONGESTION, OR RED EFFLORESCENCE)

This is a congested or slightly inflamed condition of the skin, unattended with any eruption. The part is slightly swollen, hot, tender, or itchy, and dry, and if the skin is white there is redness. The redness is effaced by pressure but reappears instantly, when it is removed. Except in transient cases the hairs are likely to be shed. It may be looked on as the first stage of inflammation, and therefore when it becomes aggravated it may merge in part or in whole into a papular, vesicular, or pustular eruption.

Erythema may arise from a variety of causes and is often designated in accordance with its most prominent cause. Thus the chilling, or partial freezing, of a part will give rise to a severe reaction and congestion. Heat and burning have a similar effect, and this often comes

from exposure to the direct rays of the sun. The skin that does not contain protecting pigment and that does not perspire is most affected; and hence the white face or white leg of a horse becoming dried by the intensity of the sun's rays often suffers to the exclusion of the rest of the body (white face and foot disease). The febrile state of the general system is also a potent cause; hence the white-skinned horse is more susceptible if kept on a heating ration of buckwheat or even of wheat or corn. Contact of the skin with oil of turpentine or other essential oils, with irritant liquids, vegetable or mineral, with rancid fats, with the acrid secretions of certain animals, with pus, sweat, tears, urine, or liquid feces, will produce congestion or even inflammation. Chafing or intertrigo, is a common cause, and is especially likely to affect the fat horse between the thighs, by the side of the sheath or scrotum, on the inner side of the elbow, or where the harness chafes on the poll, shoulder, back, breastbone, and under the tail. The accumulation of sweat and dust between the folds of the skin and on the surface of the harness, and the specially acrid character of the sweat in certain horses, contribute to chafing. The heels often become congested owing to the irritation caused by the short, bristly hairs in clipped heels. Again, congestion may occur from friction by halter, harness, or other foreign body under the pastern, or inside the thigh or arm, or by reason of blows from another foot (cutting, interfering, overreach). Finally, erythema is especially likely to occur in the spring, when the coat is being shed, and the hair follicles and general surface are exposed and irritable in connection with the dropping of the hairs.

Prevention.—If due only to a local irritant, erythema will usually disappear when the cause has been removed, but when the feeding or system is at fault these conditions must first be corrected. While the coat is being shed the susceptibility will continue, and the aim should be to prevent the disease from developing and advancing so as to weaken the skin, render the susceptibility permanent, and lay the foundation of persistent or frequently recurring skin disease. Therefore at such times the diet should be nonstimulating, any excess of grain, and above all of buckwheat, corn, or wheat, being avoided. A large grain ration should not be given at once on return from hard work, when the general system and stomach are unable to cope with it; when perspiring and fatigued, the animal should not be given more than a swallow or two of cold water, nor should it be allowed a full supply of water just after the grain ration; the animal should not be overheated or exhausted by work, nor should dried sweat and dust be allowed to accumulate on the skin or on the harness pressing on it. The exposure of the affected heels to dampness, mud, and snow, and, above all, to melting snow, should be guarded against; light, smooth, well-fitting harness is desirable, and where the saddle or collar irritates,

an incision should be made in them above and below the part that chafes, and, the padding between having been removed, the lining should be beaten to make a hollow. A zinc shield in the upper angle of the collar will often prevent chafing in front of the withers.

Treatment.—Wash the chafed skin and apply salt water (one-half ounce to the quart), extract of witch hazel, a weak solution of oak bark, or spirit of camphor. If the surface is raw use bland powders, such as zinc oxide, lycopodium, starch, or smear the surface with petrolatum or with 1 ounce of petrolatum thoroughly mixed with one-half dram of sugar of lead. In cases of chafing, rest is essential. If there is constitutional disorder or acrid sweat, 1 ounce of cream of tartar or a teaspoonful of sodium bicarbonate may be given twice daily.

CONGESTION WITH SMALL PIMPLES, OR PAPULES

In this affection there is the general redness, and other symptoms, heat, of erythema, together with a crop of elevations from the size of a poppy seed to a coffee bean, visible when the hair is reversed or felt with the finger where the hair is scanty. In white skins they vary from the palest to the darkest red. All of them do not retain the papular type but some go on to form blisters (eczema, bullae) or pustules, dry up into scales, break out into open sores, or extend into larger swellings (tubercles). The majority, however, remaining as pimples, characterize the disease. When these elevations are very itchy the rubbing breaks them open, and the resulting sores and scales hide the true nature of the eruption.

The general and local causes may be the same as for erythema, and in the same animal one portion of the skin may have simple congestion and another adjacent papules. As the inflammatory action becomes more pronounced, the irritation and itching are usually greater, the animal rubbing and biting itself severely. This itching is especially severe in the forms that attack the roots of the mane and tail, and there the disease is often so persistent and troublesome that the horse is rendered virtually useless.

The bites of insects often produce a papular eruption, but in many such cases the swelling extends wider into a buttonlike elevation one-half inch to an inch in diameter. The same remarks apply to the effects of the poison ivy and poison sumac.

Treatment.—In papular eruption first remove the cause, then apply the same general remedies as for simple congestion. In the more inveterate or chronic cases use a lotion of one-half ounce potassium sulfide in 2 quarts of water, to which a little castile soap has been added, or use a wash consisting of one-half ounce of oil of tar, 2 ounces of castile soap, and 20 ounces of water.

ECZEMA (INFLAMMATION WITH BLISTERS)

In this condition the skin is congested, thickened, warm (white skins are reddened), and has a thick crop of little blisters formed by effusions of a straw-colored fluid between the true skin and the cuticle. The blisters range in size from that of a millet seed to that of a pea and often crack open and allow the escape of the fluid, which concretes as a slight yellowish scab or crust around the roots of the hairs. This exudation and the incrustation are especially common where the hairs are long, thick, and numerous, as in the region of the pastern of heavy draft horses. The term "eczema" is now applied generally to eruptions of all kinds that depend on internal disorders or constitutional conditions and that tend to recurrences and inveteracy. Eczema may appear on any part of the body, but in horses it is especially common on the heels and the lower parts of the legs, and less frequently on the neck, shoulder, and abdomen. The legs appear to be especially susceptible because of their position, all blood having to return from them against the action of gravity and congestions and swellings being common, because of the abundance of blood vessels in this part of the skin and because of the frequent contact with the irritant dung and urine and their ammoniacal emanations. The legs further suffer from contact with wet and mud when the animal is at work, from snow and ice, from drafts of cold air when wet, from washing with caustic soaps, or from the relaxing effects of a too deep and abundant litter. Among other causes are indigestion and the presence of irritant substances in the blood and sweat, the result of medicated feeds and condition powders (aromatics, stimulants), green feed, new hay, new oats, buckwheat, wheat, corn, diseased potatoes, smut or ergot in grains, decomposing green feed, brewers' grains, or kitchen garbage. The excitement in the skin, caused by shedding the coat, lack of grooming, hot weather, or hot, boiled, or steamed feed conduces to the eruption. Lastly, any sudden change of feed may induce the inflammation.

The blisters may in part go on to suppuration so that vesicles and pustules often appear on the same patch, and, when raw from rubbing, the true nature of the eruption may be completely masked. In well-fed horses, kept in close stables with little work, eczema of the legs may last for months or years. It is a troublesome affection in draft stallions.

Treatment.—This disease is so often the result of indigestion that a laxative of 1 pound of Glauber's salt in 3 or 4 quarts of water or 1½ pints of olive oil is often necessary to clear away irritants from the alimentary canal. Following this, in recent and acute cases, give 2 drams of potassium acetate or potassium bicarbonate twice a day in the drinking water. If the bowels still become costive, give daily

1 ounce of sodium sulfate and 20 grains of powdered nux vomica. In debilitated horses combine the nux vomica with one-half ounce of powdered gentian root. As a wash for the skin use 1 dram of sodium bicarbonate and 1 dram of carbolic acid in a quart of water, after having cleansed the surface with tepid water. Use the same precautions in regard to feeding, stabling, and care of harness as in simple congestion of the skin.

In the more inveterate forms of eczema more active treatment is required. Soak the scabs in fresh sweet oil, and in a few hours remove these with tepid water and castile soap; then apply an ointment of sulfur or iodide of sulfur daily. If this seems to be losing its effect after a week, change to mercurial ointment or a solution of potassium sulfide, or sodium hyposulfite, 3 drams to the quart of water.

INFLAMMATION WITH PUSTULES

In this affection the individual elevations on the inflamed skin have in the center a small sac of white, creamy pus, in place of the clear liquid of a blister. They vary in size from that of a millet seed to that of a hazelnut. The pustules of glanders (farcy buds) can be distinguished by the watery contents and the cordlike swelling, extending from the pustules along the line of the veins, and those of boils by the inflammation and sloughing out of a core of the true skin. The hair on the pustule stands erect and is often shed with the scab. When itching is severe the parts become excoriated by rubbing, and, as in the other forms of skin disease, the character of the eruption may become indistinct. Old horses suffer mainly at the root of the mane and tail and about the heels, and suckling foals around the mouth, on the face, inside the thighs, and under the tail.

Pustules, like eczema, are especially likely to result from unwholesome feed and indigestion, from a sudden change of feed—above all, from dry to green. In foals it may result from overheating of the mare and allowing the foal to suckle while the mare is warm, or by milk rendered unwholesome by faulty feeding of the dam. If a foal is brought up by hand the souring and other decompositions in the milk derange the digestion and cause such eruption. Vetches and other plants affected with honeydew and buckwheat have been the cause of these eruptions on white portions of the skin. Disorders of the kidneys or liver are common causes of this affection.

Treatment.—Apply soothing ointments, such as benzoinated zinc oxide, or petrolatum with 1 dram of zinc oxide in each ounce. Or a wash of 1 dram of sugar of lead or 2 drams of sodium hyposulfite in a quart of water may be applied freely. If the skin is already abraded and scabby, smear thickly with petrolatum for some hours, then wash with soapsuds and apply the previously mentioned dressings. When the excoriations are indolent they may be painted with a solution of

lunar caustic, 2 grains to 1 ounce of distilled water. Counteract costiveness and remove intestinal irritants by the same means as in eczema, and follow this with one-half-ounce doses daily of sodium hyposulfite, and one-half-ounce doses of gentian. In all, the greatest care must be taken with regard to feed, feeding, watering, cleanliness, and work. In wet and cold seasons predisposed animals should, as far as possible, be protected from wet, mud, snow, and melted snow—above all, from that which has been melted by salt.

BOILS (FURUNCLES)

These may appear on any part of the skin but are especially common on the lower parts of the legs and on the shoulders and back where the skin is irritated by accumulated secretion and chafing with the harness. In other cases the cause is constitutional or attended with unwholesome diet and overwork with loss of general health and condition. They also follow weakening diseases, notably strangles, in which irritants are retained in the system from overproduction of poisons and effete matter during fever, and imperfect elimination. There is also the presence of a pus-producing bacterium, by which the disease may be maintained and propagated.

Although boils contain pus, they differ from simple pustules in that they affect the deepest layers of the true skin and even the superficial layers of the connective tissues beneath, and in the death and sloughing out of the central part of the inflamed mass (core). The depth of the hard, indurated, painful swelling and the formation of this central mass or core, which is bathed in pus and slowly separated from surrounding parts, serve to distinguish the boil alike from the pustule, farcy bud, and superficial abscess.

Treatment.—To treat very painful boils a free incision with a lancet in two directions, followed by a dressing with one-half an ounce of carbolic acid in a pint of water, bound on with cotton or lint, may check their growth. The more common course is to apply a warm poultice of linseed meal or wheat bran, and renew daily until the center of the boil softens, when it should be lanced and the core pressed out.

If the boil is smeared with a blistering ointment of cantharides and a poultice put over it, the formation of pus and separation of the core are often hastened. A mixture of sugar and soap laid on the boil is equally good. Cleanliness of the skin and the avoidance of all causes of irritation are important items, and the application to the skin of a teaspoonful of sodium bicarbonate in a pint of water once or twice a day will sometimes assist in warding off a new crop.

NETTLERASH (SURFEIT, OR URTICARIA)

This is an eruption in the form of cutaneous nodules, from the size of a hazelnut to that of a hickory nut, transient, with little disposition to

the formation of either blister or pustule, and usually connected with shedding of the coat, sudden changes of weather, and unwholesomeness or sudden change in the feed. It is most frequent in the spring and in young and vigorous animals. The swelling involves the entire thickness of the skin and terminates by an abrupt margin in place of shading off into surrounding parts. When the individual swellings run together, extensive patches of thickened integument are formed. These may appear on any part of the body and may be general; the eyelids may be closed, the lips immovable, or the nostrils so thickened that breathing becomes difficult and snuffling. It may be attended with constipation or diarrhea or by colicky pains. The eruption is sudden, the whole skin being sometimes covered in a few hours, and it may disappear with equal rapidity or persist for 6 to 8 days.

Treatment.—This consists in clearing out the bowels by 5 drams of Barbados aloes or 1 pound of Glauber's salt, followed by daily doses of one-half ounce powdered gentian and 1 ounce of Glauber's salt. A weak solution of alum may be applied to the swellings.

PITYRIASIS (SCALY SKIN DISEASE)

This affection is characterized by an excessive production and detachment of dry scales from the surface of the skin (dandruff). It usually results from some fault in digestion and an imperfect secretion from the sebaceous glands and is most common in old horses. Some authorities attribute it to feed rich in saccharine matter (carrots, turnips) and to the excretion of oxalic acid by the skin. The condition is found in horses irregularly worked and well fed. In such cases it is advisable to avoid saccharine feed. Another treatment is to give the horse a laxative followed by 1-dram doses of potassium carbonate, and the affected parts may be bathed with soft, tepid water and smeared with an ointment made with petrolatum and sulfur. In obstinate cases sulfur may be given daily in the feed.

PRURITUS (NERVOUS IRRITATION OF THE SKIN)

This is seen in horses fed to excess on grain and hay, kept in close stables, and worked irregularly. Though most common in summer, it is often severe in hot, close stables in winter. Pimples, vesicles, and abrasions may result, but as the itching is as severe on other parts of the skin, these may be the result of scratching merely. It is especially common and inveterate about the roots of the mane and tail.

Treatment.—This consists in a purgative (Glauber's salt, 1 pound) and a restricted, laxative diet. If the case is obstinate, give daily 1 ounce of sulfur and 20 grains of nux vomica, or 2 drams of potassium carbonate in a quart of water will sometimes benefit. If the disease

is caused by pinworms in the rectum, the itching of the tail may be remedied by an occasional injection of a quart of water in which chips of quassia wood have been steeped for 12 hours.

HERPES

This name has been applied to a disease in which there is an eruption of minute vesicles in circular groups or clusters, with little tendency to burst but rather to dry up into fine scabs. If the vesicles break, they exude a slight, gummy discharge that concretes into a small, hard scab. It is apparently noncontagious and not appreciably connected with any disorder of internal organs. It sometimes accompanies or follows specific fevers, and is, on the whole, most frequent at the seasons of changing the coat—spring and autumn. It is seen on the lips and pastern but may appear on any part of the body. The duration of the eruption is 2 weeks or even more, the tendency being to spontaneous recovery. The affected part is irritable, causing sensitiveness and a disposition to rub, out of proportion to the extent of the eruption.

Treatment.—It may be treated by zinc oxide ointment, and to relieve the irritation a solution of belladonna in water, or oil of peppermint may be used. A tonic such as one-half an ounce of Peruvian bark daily for a week, may be serviceable in bracing the system and producing an indisposition to the eruption.

BLEEDING SKIN ERUPTIONS (DERMATORRHAGIA PARASITICA)

In China, Hungary, Spain, and other countries, horses frequently suffer from the presence of a threadworm (*Setaria haemorrhagica* (Railliet))=*Parafilaria multipapillosa* (Condamine and Drouilly)) in the subcutaneous, intermuscular, and interfascicular connective tissues causing effusions of blood under the scurf skin and incrustations of dried blood on the surface. The eruptions, which appear mainly on the sides of the trunk, but may cover any part of the body, are rounded elevations about the size of a small pea or larger, containing blood that bursts through the scurf skin and dries like a reddish scab around the erect, rigid hairs. These swellings appear in groups, which remain for several days, gradually diminishing in size; new groups appear after an interval of 3 or 4 weeks, the manifestation being confined to 3 or 4 months of spring and disappearing in winter. A horse will suffer for several years in succession and then permanently recover, although fatal cases sometimes occur. It is reported that when cases of the disease are imported into France the disease appears in attenuated form the second year and then disappears without treatment. To find the worm the hair is shaved from the part where the elevations are felt, and as soon as a bleeding point is shown the superficial layer is laid open with the knife, when the parasite will be seen drawing itself back

into the parts beneath. The worm is about 1 inch to almost 3 inches long and like a stout thread, thicker toward the head than toward the tail, and with numerous little papilliform elevations around the head. The adult female worm produces numerous eggs that contain embryos when deposited. Apparently the eggs hatch in the blood. In all probability the worm has an intermediate host, perhaps an insect, which transmits it from one horse to another.

Treatment.—This is not satisfactory, but the affected surface should be kept clean by sponging, and the pressure of harness on any affected part must be avoided. The part may be washed frequently with a strong solution of potassium sulfide. Rest may be essential to recovery.

SUMMER SORES

The summer sores of horses (dermatitis granulosa, boils) have been traced to the presence in the skin of a roundworm, 3 millimeters in length and very slender. These worms were long known as *Filaria irritans* but have been found to be the larvae of the stomach worms, *Habronema* spp., of the horse. The sores may be as small as a millet seed but more frequently are of the size of a pea and may become an inch in diameter. They may appear on any point but are especially obnoxious where the harness presses, or on the lower parts of the legs. The sores cause intense itching, and the victim rubs and bites the part until extensive raw surfaces are produced. Aside from the effects of such friction, the sore is covered by a brownish-red, soft, pulpy material with cracks or furrows filled with serous pus. In the midst of the softened mass are small, firm, rounded granulations, fibrinous, and even caseated, and when the soft, pultaceous material has been scraped off, the surface bears a resemblance to the fine, yellow points of miliary tuberculosis in the lung. The worm or its débris is found in the center of such masses. These sores are very obstinate, resisting treatment for months in summer, and even after apparent recovery during cold weather they may appear anew the following summer. In bad cases the rubbing and biting may cause exposure of synovial sacs and tendons and cause irremediable injury. Even in winter, however, when the diseased process seems arrested, there remain the hard, firm, resistant patches of the skin with points in which the diseased product has become softened like cheese.

The apparent subsidence of the disease in winter is attributed to the coldness and comparative bloodlessness of the skin, whereas in summer, with high temperature, active circulation, and rapid cell growth, inflammation is increased, itching follows, and from the animal's rubbing the part the irritation is persistently increased. The hotter the climate the more troublesome the disease.

Descazeaux and others have shown that the worms found in these summer sores are larval forms of the stomach worms of the horse,

especially *Habronema megastoma* and *H. muscae*. Ransom and others have shown that the larvae of these worms develop in the common housefly and other flies, the fly becoming infested as a maggot in horse manure. *H. microstoma*, however, usually develops in stable flies and rarely in houseflies. Infestation with the adult worms in the stomach of the horse (pl. V, fig. 4) may take place through the ingestion of such infested flies or by the escape of larvae from the proboscis of the fly as it feeds on the moist lips of the horse. In view of this it may be surmised that summer sores may arise as the result of flies so infested feeding on the moisture on the skin of the horse, and this theory has the support of some experimental and clinical evidence.

Preventive measures consist in the removal of the adult worms from the stomach of the horse by the use of anthelmintics, the destruction of the embryos in the manure, fly-control measures, and the use of clean bedding. The protection of all wounds and skin abrasions from flies by means of bandages, fly repellents, etc., is also of importance in regions where summer sores occur. Such anthelmintics as carbon bisulfide and carbon tetrachloride will probably kill the stomach worms of horses whenever the worms are exposed to the action of the drugs, but the worms that are embedded in the mucosa or in nodules are probably not accessible to any drugs used at present.

Treatment.—This consists, first, in placing the animal in a cool place and showering the surface of the skin with cold water. The parasite may be destroyed by rubbing the surface of the wound with iodoform and covering it with a layer of collodion, and repeating the applications every 24 hours for 15 days, or until the sores heal. Ether or chloroform, poured on cotton and applied to the sore for 2 minutes before painting it with collodion, may be used in place of iodoform.

Descazeaux recommends the application and injection of 2 to 3 percent of trypan blue, though he states that the only truly efficacious treatment is the early and complete ablation of the invaded tissue.

CRACKED HEELS (SCRATCHES, OR CHAPS ON KNEE AND HOCK)

This usually sets in with swelling, heat, and tenderness of the hollow of the heel, with erections of the hairs and redness (in white skins), with stiffness and lameness, which may be extreme in irritable horses. Soon slight cracks appear transversely and may gain in depth and width and even suppurate. More frequently they become covered at the edges or throughout by firm incrustations resulting from the drying of the liquids thrown out, and the skin becomes increasingly thick and rigid. A similar condition occurs behind the

knee and in front of the hock (malanders and sallenders), and may extend from these points to the hoof, virtually incasing that side of the leg in a permanent incrusting sheath.

Causes.—Besides a heavy lymphatic constitution, which predisposes to this affection, the causes are overfeeding on grain, unwholesome fodder, close, hot, dirty stables, constant contact with dung and urine and their emanations, working in deep, irritant mud; above all, in limestone districts, irritation by dry limestones or sandy dust in dry weather on dirt roads; also cold drafts, snow, and freezing mud, washing the legs with caustic soap, wrapping the wet legs in thick woolen bandages that soak the skin and render it sensitive when exposed next day, clipping the heels, weak heart and circulation—naturally so or supervening on overwork—imperfect nourishment, impure air, lack of sunshine, chronic exhausting or debilitating diseases, or functional or structural diseases of the heart, liver, or kidneys. These last induce dropsical swelling of the legs (stocking), weaken the parts, and induce cracking. Finally the cicatrix of a preexisting crack, weak, rigid, and unyielding, is likely to reopen under any severe exertion; hence rapid paces and heavy draft are active causes.

Treatment.—In treatment the first step is to ascertain and remove the cause whenever possible. If there is much local heat and inflammation, a laxative (5 drams of aloes or 1 pound of Glauber's salt) may be given, and for the pampered animal the grain should be reduced or replaced altogether by bran mash, flaxseed, and other laxative, nonstimulating feed. To the debilitated animal, on the other hand, nutritious feed and tonics may be given. When the legs swell, exercise on dry roads, hand rubbing, and evenly applied bandages are good, and mild astringents, such as extract of witch-hazel, may be applied and the part subsequently rubbed dry and bandaged. If there is much heat but unbroken skin, a lotion of 2 drams of sugar of lead to 1 quart of water may be applied on a thin bandage, covered in cold weather with a dry one. The same may be used after the cracks appear, or a solution of sulfurous acid 1 part, glycerin 1 part, and water 1 part, applied on cotton and well covered by a bandage. In case these should prove unsuitable to the particular case, the part may be smeared with petrolatum 1 ounce, sugar of lead 1 dram, and carbolic acid 10 drops.

INFLAMMATION OF THE HEELS WITH SEBACEOUS SECRETION (GREASE-HEEL, OR CANKER)

This is a specific affection of the heels of horses usually associated with an offensive discharge from the numerous sebaceous glands, and, in bad cases, the formation of red, raw excrescences (grapes) from the

surface. It should be distinguished (1) from simple inflammation in which the special fetid discharge and the tendency to the formation of grapes are absent; (2) from horsepox, in which the abundant exudate forms a firm, yellow incrustation around the roots of the hair and is embedded at intervals in the pits formed by the individual pocks, and in which there is no vascular excrescence; (3) from foot scabies (mange), in which the presence of a mite is distinctive; (4) from lymphangitis, in which the swelling appears suddenly, extending around the entire leg as high as the hock, and on the inner side of the thigh along the line of the vein to the groin, and in which there is active fever, and (5) from erysipelas, in which there is active fever, the implication of the deeper layers of the skin and of the parts beneath giving a boggy feeling to the parts, the absence of the fetid, greasy discharge, and finally a tendency to form pus loosely in the tissues without any limiting membrane, as in abscess. Another distinctive feature of grease-heel is its tendency to implicate the skin that secretes the bulbs or heels of the horny frog and in the cleft of the frog, constituting the disease known as canker.

Causes.—The predisposing causes of grease-heel are essentially the same as those of simple inflammation of the heel, discussed in the preceding section. Though bacteria of different kinds are present, they tend mainly to aggravation of the disease and have not been shown to be causes.

Symptoms.—The symptoms vary according to whether the disease comes on suddenly or more slowly. In the first case there is a sudden swelling of the skin in the heel, with heat, tenderness, itching, and stiffness, which is lessened during exercise. In the slower forms there is only a slight swelling after rest, and with little heat or inflammation for a week or more. Even at this early stage, a slight, serous oozing may be detected. As the swelling increases, extending up toward the hock or knees, the hairs stand erect and are covered with a grayish, milky, and fetid moisture. The odor of the discharge draws attention to the part whenever one enters the stable, and the swollen pastern and wet, matted hairs on the heel draw attention to the seat of the malady. If properly treated the disease may not advance further, but if neglected the tense, tender skin cracks open, leaving open sores from which bloody growths develop, constituting the grapes. The hair is shed, and the heel may appear as a mass of rounded, red, angry excrescences that bleed on handling and are covered with the now repulsively fetid, decomposing discharge. During this time there is little or no fever, the animal eats well, and but for its local trouble it might continue at work. When the malady extends to the frog, there is a fetid discharge from its cleft or from the depressions at its sides, and this gradually extends to its whole

surface and on the adjacent parts of the sole. The horn meanwhile becomes soft, whitish, and fleshy in aspect, its constituent tubes being greatly enlarged and losing their natural cohesion; it grows rapidly above the level of the surrounding horn, and when pared is found to be penetrated to an unusual depth by the secreting papillae, which at intervals bulge out into a vascular fungous mass comparable to the grapes.

Treatment.—In treatment hygienic measures are first to be considered but are in themselves insufficient to establish a cure. All local and general conditions that favor the production and persistence of the disease must be guarded against. Above all, cleanliness and purity of the stable and air must be obtained; also nourishing diet, regular exercise, and the avoidance of local irritants—septic, muddy, and chilling. At the outset benzoated zinc oxide ointment may be used to advantage. A still better dressing is made with 1 ounce of petrolatum, 2 drams of zinc oxide, and 20 drops of iodized phenol. If the surface is much swollen and tender, a flaxseed poultice may be applied, over the surface of which has been poured some of the following lotion: Sugar of lead, $\frac{1}{2}$ ounce; carbolic acid, 1 dram; water, 1 quart. Many astringents have been used with more or less advantage, and some particular one seems to suit particular cases or patients. To destroy the grapes, they may be rubbed daily with strong caustics (copperas, bluestone, lunar caustic), or each may be tied at its base or neck with a strong waxed thread to produce sloughing or, finally and more speedily, they may be removed through operative procedure by a veterinarian. After the removal of the grapes the astringent dressing must be applied persistently to the surface. When the frog is affected it must be pared to the quick and dressed with dry caustic powders (quicklime, copperas, bluestone) or carbolic acid and subjected to pressure, the dressing being renewed every day at least.

ERYSIPELAS

This is a specific contagious disease, characterized by spreading, dropsical inflammation of the skin and subcutaneous tissues, attended with general fever. It differs from most specific diseases in that there is no definite period of incubation, no regular course and duration, and it does not confer immunity on the animal after recovery. In other words, one attack of erysipelas predisposes to another, partly, doubtless, by the loss of tone and vitality in the affected tissues, but also, perhaps, because of the survival of the infecting germ.

Cause.—Microbes found in the inflammatory product are the true cause of erysipelas, as they transmit the disease from man to animals and from one animal to another. This transition may be direct or through the medium of infected buildings or equipment. Yet from the varying severity of erysipelas in different outbreaks and localities

it has been surmised that different microbes are operative in this disease, and a perfect knowledge of them might enable one to divide erysipelas into two or more distinct affections. One must recognize it as a specific inflammation due to a bacterial infection poison and closely allied to septicemia. Infection may take place through a wound or without any recognizable skin lesion. Erysipelas that follows a wound is usually much more violent than the other form, the difference being doubtless due partly to the lowered vitality of the wounded tissues and to the oxidation and septic changes that may take place on the raw, exposed surface. As apparently idiopathic cases may be due to infection through bites of insects, the small amount of poison inserted may moderate the violence.

This affection may attack a wound on any part of the horse's body, but apart from wounds, it is most frequent about the head and the hind legs. It can be distinguished from ordinary inflammations by its gradual extension from the point first attacked; by the abundant liquid exudation into the affected part; by the tension of the skin over the affected part; by its soft, boggy feeling, allowing it to be deeply indented by the finger; by the abrupt line of limitation between the diseased and the healthy skin, the former descending suddenly to the healthy level instead of shading off slowly toward it; by the tendency of the inflammation to extend deeply into the subjacent tissues and into the muscles and other structures; by the great tendency to death and sloughing of portions of skin and of the structures beneath; by the formation of pus at different points throughout the diseased parts without any surrounding sac to protect the surrounding structures from its destructive action, and without the usual disposition of pus to advance harmlessly toward the surface and escape; and, finally, by a low, prostrating type of fever, with elevated temperature of the body, coated tongue, excited breathing, and loss of appetite. The pus when escaping through a lancet wound is grayish, brownish, or reddish, with a heavy or fetid odor, and intermixed with shreds of broken-down tissues. The most destructive form, however, is that in which pus is deficient and gangrene and sloughing more speedy and extensive.

Treatment.—This should consist mainly in the elimination from the system of the poisonous products of the bacteria by laxatives and diuretics, the sustaining of the failing vitality by tonics and stimulants, above all those of the nature of antiferments, and the local application of astringent and antiseptic agents. The following internal treatment may be used: 4 drams of tincture of ferric chloride and $\frac{1}{2}$ dram of ammonium chloride or potassium chlorate, given in a pint of water every 2 hours. Locally a strong solution of alum or ferrous sulfate may be used; or the affected part may be painted with tincture of ferric chloride or with iodized phenol.

In mild cases a lotion of 4 drams of sugar of lead in a quart of water may be applied. It is desirable to avoid the formation of wounds and the consequent septic action, yet when pus has formed and is felt by the fluctuation under the finger to be approaching the surface it should be freely opened with a clean, sharp lancet, and the wound thereafter disinfected daily with carbolic acid 1 part to water 10 parts, with a saturated solution of sodium hyposulfite or with powders of iodoform or salol.

HORSEPOX, ANTHRAX, AND CUTANEOUS GLANDERS

These subjects are discussed under the head of Infectious Diseases.

CALLUSES

These are simple thickening and induration of the cuticle caused by continued pressure, notably in lying down on a hard surface. Being devoid of hair, they cause blemishes; hence, smooth floors and good bedding should be provided as preventives.

HORNY SLOUGHS (SITFASTS), OR SLOUGHING CALLUSES

These are circumscribed sloughs of limited portions of the skin, the result of pressure by badly fitting harness or by irritating masses of dirt, sweat, and hairs under the harness. They are most common under the saddle but may be found under the collar or breeching as well. The horny slough is a piece of dead tissue that would be thrown off except that it has formed firm connections with the fibrous skin beneath, or even deeper with the fibrous layers (fascia) of the muscles, or with the bones, and is thus bound in its place as a persistent source of irritation. This slough may thus involve the superficial part of the skin only, or the whole thickness of the skin, and even of some of the structures beneath. The first object is to remove the dead irritant by dissecting it off with a sharp knife, after which the sore may be treated with simple wet cloths or a weak carbolic-acid lotion, like a common wound. If the outline of the dead mass is too indefinite, a linseed-meal poultice will make its outline more evident. If the fascia or bone has become gangrenous, the dead portion must be removed with the hornlike skin. Any surgical treatment should be performed by a veterinarian. During and after treatment, the horse must be kept at rest, or the harness must be so adjusted that no pressure can come near the affected parts.

WARTS

These are essentially a morbid overgrowth of the superficial papillary layer of the skin and of the investing cuticular layer. They are mostly seen in young horses, about the lips, eyelids, cheeks, ears, beneath the belly, and on the sheath, but may develop anywhere. The smaller ones may be clipped off with scissors and the raw surface

cauterized with bluestone. The larger ones may be sliced off with a sharp knife, or if there is a narrow neck they may be twisted off and the surface cauterized. If very vascular, they may be removed by a waxed thread or cord tied around their slender bases or necks, at least three turns being made around and the ends being fixed by passing them beneath the last preceding turn of the cord, so that they can be tightened day by day as they slacken by shrinkage of the tissues. If the neck is too broad it may be transfixed several times with a double-threaded needle and then be tied in sections. Very broad warts that cannot be removed in this way may be treated with applications of glacial acetic acid until the growths disappear. Protect the surrounding skin from the acid by greasing with lard or petrolatum.

BLACK PIGMENT TUMORS (MELANOMATA)

These are common in gray and in white horses on the naturally black parts of the skin at the root of the tail, around the anus, vulva, udder, sheath, eyelids, and lips. They are readily recognized by their inky-black color, which extends throughout the whole mass. They may appear as simple, pealike masses or as multiple tumors, especially around the tail, aggregating many pounds. In the horse these are usually simple tumors and may be removed with the knife. In exceptional cases they are cancerous, as is more frequently the case in man.

EPITHELIAL CANCER (EPITHELIOMA)

This sometimes occurs on the lips at the angle of the mouth and elsewhere in the horse. It begins as a small, wartlike tumor, which grows slowly at first but finally bursts open, ulcerates, and extends laterally and deeply in the skin and other tissues, destroying them as it advances (rodent ulcer). It is made up of a fibrous framework and numerous round, ovoid, or cylindrical cavities, lined with masses of epithelial cells, which may be squeezed out as a fetid, caseous material. Early and thorough removal is the most successful treatment, but this should be done only by a competent veterinarian.

DISEASES CAUSED BY VEGETABLE PARASITES OF THE SKIN

Parasite: Trichophyton tonsurans. Malady: Tinea tonsurans, or circinate ringworm.—This is especially common in young horses coming into training and work, in low-conditioned colts in winter and spring after confinement indoors, during shedding in lymphatic rather than nervous animals, and at the same time in several animals that have herded together. The disease is common to man and also to cattle, goats, dogs, cats, and in rare instances to sheep and swine. Hence it is common to find animals of different species and their

attendants suffering at the same time, the disease having been propagated from one to the other.

In the horse the symptoms are the formation of a circular, scurfy patch where the fungus has established itself, the hairs of the affected spot being erect, bristly, twisted, broken, or split up and dropping off. Later the spot first affected has become entirely bald, and a circular row of hairs around this are erect, bristly, broken, and split. These in turn are shed and a new row outside passes through the same process, so that the extension is made in more or less circular outline. The central bald spot, covered with a grayish scurf and surrounded by a circle of broken and split hairs, is characteristic. If the scurf and diseased hairs are treated with caustic-potash solution and put under the microscope, the natural cells of the cuticle and hair will be seen to have become transparent, whereas the groups of spherical cells and branching filaments of the fungus stand out prominently in the substance of both, dark and unchanged. The eruption usually appears on the back, loins, croup, chest, and head. The disease tends to spontaneous recovery in a month or two, leaving for a time a dappled coat from the spots of short, light-colored hair of the new growth.

The most effective way of reaching the parasite in the hair follicles is to extract the hairs individually, but in the horse the mere shaving of the affected part is usually enough. It may then be painted with tincture of iodine twice a day for 2 weeks. Infection about the stable may be covered up or destroyed by a whitewash of quicklime; the harness, brushes, etc., may be washed with caustic soda. The clothing may be boiled and dried.

Parasite: Achorion schænleinii. *Malady: Favus, or honeycomb ring-worm.*—Mégnin and Goyau, who describe this in the horse, say that this malady loses its characteristic honeycomb or cup-shaped appearance and forms only a series of closely aggregated, dry, yellowish crusts the size of hemp seed on the trunk, shoulders, flanks, or thighs. They are accompanied with intense itching, especially at night. The cryptogam, formed of spherical cells with a few filaments only, grows in the hair follicles and on the cuticle, and thus a crust often forms around the root of a hair. Like the other cryptogams, their color, as seen under the microscope, is unaffected by acetic acid, alcohol, ether, or oil of turpentine, whereas the cells are turned bluish by iodine. For treatment, remove the hair and apply tincture of iodine, as advised under the last paragraph.

Parasite: Microsporon furfur. *Malady: Parasitic pityriasis.*—This attacks the horse's head where the harness presses and leads to dropping of the hair, leaving bald patches covered with a branlike scurf, without any eruption, heat, tenderness, swelling, or rigidity of the skin. A lotion of carbolic acid 1 dram and water 2½ ounces is usually applied to effect a cure.

DISEASES CAUSED BY ANIMAL PARASITES OF THE SKIN

[Revised by M. C. Hall, Ph. D., D. V. M.]

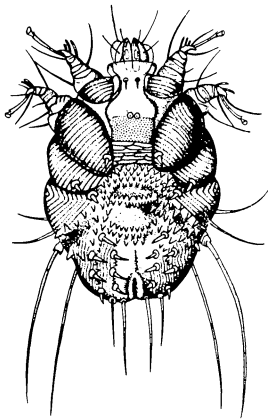
MANGE (ACARIASIS)

This affection is due to the irritation of the skin caused by the presence of nearly microscopic acari, or mites. The disease varies, however, according to the species of mite that infests the skin; so several different kinds of mange are discussed in the following paragraphs.

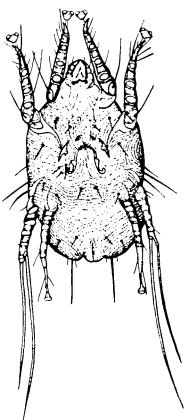
Parasite: Sarcoptes scabiei equi. Malady: Sarcoptic mange.—This particular kind of mange is confined mostly to the horse, but under favorable conditions it can be transmitted to the ass and the mule, and even to man, where it may live for some time on the human skin. The mite (pl. XXXIX, fig. 1) is nearly microscopical but may be detected with a magnifying lens among moving scurf taken from the infected skin. Like all *Sarcoptes*, it burrows little galleries in and beneath the scurf skin, where it hides and lays its eggs and where its young are hatched. It is therefore often difficult to find the parasite on the surface, unless the skin has been heated by temporary exposure to the sun or in a warm room. The mite may be detected more readily by placing scrapings on black cardboard and warming, or better by macerating scabs or scrapings in a solution of caustic soda or potash and then examining them microscopically. Like other mites, this one is very prolific, a new generation of 10 to 25 individuals being possible every 15 days, so that in 3 months the offspring of a single pair may produce generations aggregating 1,500,000 young or more. The *Sarcoptes* have less vitality than the nonburrowing mites, as they die in an hour when kept off the skin in dry air at a temperature of 145° F. They live 12 to 14 days off the skin in the damp air of a stable. In an experimental test, when these mites were kept on a piece of damp hide, all lived till the twenty-fourth day, and all were dead on the twenty-eighth day.

The symptoms of presence of these mites are an incessant, intolerable, and increasing itching of some part of the skin (head, mane, tail, back, etc.), the horse inclining toward the hand that scratches it, and moving the lips as if the animal itself were scratching. The hairs may be broken and rubbed off, but the part is never entirely bald, as in ringworm, and there may be papules or any kind of eruption or open sores from the energy of the scratching. Scabs of varying thickness may form, but the special features are the intense itching and the presence of the mite.

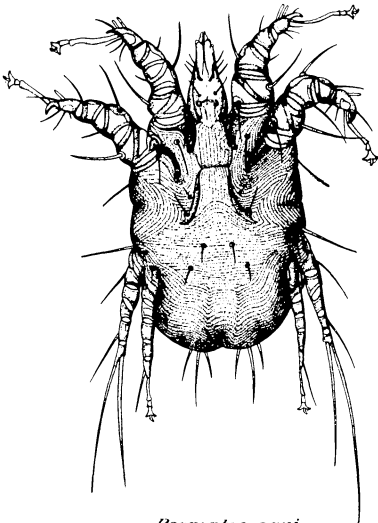
Treatment consists in the removal of the scabs by soapsuds, and, if necessary, a brush and the thorough application of tobacco, 1½ ounces, and water 2 pints, prepared by boiling. This may be applied more than once and should always be repeated in 10 to 14 days to destroy



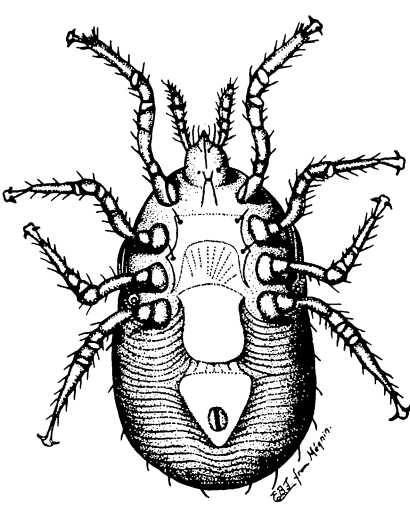
SarcOPTES scabiei var. *equi*



ChoriOPTES equi



PsorOPTES equi



Dermanyssus gallinae

MITES THAT INFEST THE HORSE.

the new brood that may have been hatched in the interval. All harness and stable utensils should be similarly treated; blankets and rubbers may be boiled, and the stalls should be covered with a white-wash of quicklime, containing one-fourth pound of calcium chloride to the gallon.

When there are too many animals to treat by means of hand dressings, the lime-and-sulfur dip or the tobacco dip may be used and is very effective, though the cresol dips are fairly effective. These dips may be purchased and made up in the dilution called for on the container. The affected animals may be dipped when the number warrants it and facilities are available; otherwise the dips may be applied with a swab or a spray pump. Directions for constructing a dipping vat may be obtained from the United States Department of Agriculture on application. Any treatment used should be repeated in 10 to 14 days. If the stables are not disinfected, animals should be removed after treatment and put in clean stables or on clean pasture for at least a month to allow the mites in the infested stables to die. Otherwise the disease may recur.

Parasite: Psoroptes communis equi (*Dermatocoptes equi*, *Dermatodectes equi*). *Malady: Psoroptic mange*.—Psoroptic mange in horses is less common than sarcoptic mange, and as the parasite (pl. XXXIX, fig. 3) bites only the surface and lives among the crusts under the shelter of the hair, it is easily discovered. It reproduces rapidly and causes symptoms similar to those produced by the *Sarcoptes* parasite. The same treatment will suffice and is more promptly effectual. The disinfection of the stable must be thorough, as the *Psoroptes* parasites will survive 20 to 30 days in the moist atmosphere of a stable and may even revive after 6 to 8 weeks when subjected to moist warmth. Infested pastures will therefore be dangerous to horses for that length of time, and such pastures, with infected rubbing posts, etc., should not be used for more than two months.

Parasite: Chorioptes equi (*Symbiotes equi*, *Dermatophagus equi*, *Chorioptes spathiferus*). *Malady: Foot mange*.—The mite (pl. XXXIX, fig. 2) attacks the heels and lower parts of the legs, especially the hind ones, and may be present for years without extending upon the body. Like the *Psoroptes* mite, it lives on the surface, on the hairs, and among the scabs. It gives rise to great itching, stamping, rubbing of the one leg with the other, and the formation of papules, wounds, ulcerous sores, and scabs. The intense itching will always suggest this parasite, and the discovery of the mite will identify the disease. The treatment is the same as for the *Sarcoptes* but may be confined to the legs and the parts with which they come in contact.

Parasite: Dermanyssus gallinae, or *chicken acari*. *Malady: Poultry mange*.—This is a large-sized mite, though usually miscalled "hen louse," and the disease "poultry lousiness." The mite (pl. XXXIX,

fig. 4) lives in droppings and in crevices of chicken houses but temporarily passes onto the skin of man and of the horse and other quadrupeds, when occasion serves. It causes much irritation, with the eruption of papules or vesicles and the formation of sores and scabs. The examination of the skin is usually fruitless, as the attacks are mostly made at night and the effects may be seen only during the day. The proximity of hen manure swarming with the mites explains the trouble, and the removal of this and a white-washing with quicklime, with or without calcium chloride, will prevent future attacks. The skin may still require bland ointments or lotions, as for congestion.

Parasite: Larva of a Trombicula, Leptus americanus, or harvest mite, commonly called chigger. Malady: Autumn mange.—This parasite is a brick-red acarus, visible to the naked eye on dark ground and living on green vegetation in many localities. It attacks man and the horse, ox, dog, etc., attaching to the skin and giving rise to small papules and intolerable irritation. This continues for 2 or 3 days only from a single invasion but will last until cold weather sets in if there is a fresh invasion daily. Horses on pasture suffer mainly on the lower part of the face. If they are kept indoors the disease will disappear, or if left at pasture a weak tar water or solution of tobacco may be applied to the face. The application of sulfur ointment is beneficial, and flowers of sulfur is protective.

TICKS

The wood ticks are familiar to inhabitants of uncultivated lands and are troublesome parasites to man and beast alike. The tick lives on bushes and attaches itself to the mammal to feed. When it is engorged it drops off to molt, and finally the female drops to lay eggs on the soil. The tick produces great irritation by boring into the skin with its armed proboscis. If pulled out, the head and thorax are often left in the skin. The ticks may be covered with oil to shut out the air from their breathing pores. Touching them with a hot penknife causes them to release their hold. The application of crude oil or the arsenical dips used for cattle is fatal to ticks on horses.

GRUBS IN SKIN

Parasite: Hypoderma lineatum. Malady: Larvae (grubs) under the skin.—The larvae of a fly (usually *Hypoderma lineatum*), commonly in the skin of cattle and known as "warbles," are occasionally found in little sacs beneath the skin of horses. The mature larva escapes in early summer and develops into a fly. In districts where they exist the grubs should be pressed out of the skin in the course of the winter and destroyed.

SCREWORM OR FLYBLOW

The following flies, among others, deposit their eggs on open sores or on wet, filthy parts of the skin, where their larvae or grubs give rise to serious trouble: *Lucilia caesar* (bluebottle), *Cochliomyia hominivorax* (= *C. americana*) and *C. macellaria* (screwworm), *Calliphora vomitoria* (meat fly), and *Sarcophaga* spp. (flesh flies).

To prevent their attacks, wet, filthy hair should be removed and wounds kept clean and rendered antiseptic by the application of commercial pine-tar oil. If the grubs are already present they should be picked off and one of these dressings freely applied. For the destruction of maggots in deep wounds, commercial 90 percent benzol should be used. This may be poured directly into the wound, after any exudate present in the wound has been removed with cotton.

FLIES

A number of flies attack horses and suck their blood, producing great annoyance and in some instances death. These insects not only suck the blood but also often instill an acid poison into the skin and in exceptional cases transfer infectious diseases from animal to animal by inoculation.

Various devices are resorted to to prevent the attacks, as to sponge the skin with a decoction of walnut or elder leaves, or of tobacco, to dust with Persian insect powder, to keep a light blanket or fly net on the horse, to close doors and windows with fine screens and destroy by pyrethrum any flies that have gained admission, to remove all manure heaps that would serve as breeding places for flies, to keep the stalls clean and deodorize with gypsum, and to spread in them dry calcium chloride. For the poisoned bites apply ammonia, or a solution of 1 part of carbolic acid in 20 parts of sweet oil or glycerin, or one-fourth ounce of sodium bicarbonate and 1 dram of carbolic acid in a quart of water may be used.

A large number of fly repellents have been recommended, but most of them must be applied daily in order to maintain the protective effect. Among the repellents used are carbolic solutions, pine tar, oil of tar, fish oil, laurel oil, oil of citronella, oil of sassafras, oil of camphor, and cod-liver oil. Some of these must be used judiciously or they will result in poisoning or removal of the hair from the animal in some instances. Ten-percent oil of tar in Beaumont oil or in cottonseed oil was found to be safe and efficacious by Graybill.

The use of the fly-maggot trap noted under stomach worms of the horse, is recommended.

FLEAS

The flea of man and those of poultry, when numerous, will bite the horse and give rise to rounded swellings on the skin. To dispose

of them, clear the surroundings of the grublike larvae and sponge the skin with a solution of 1 part of carbolic acid in 50 parts of water. Other animals should be kept free from fleas or kept away from the vicinity of the stable. The soil or floor may be sprinkled with quicklime, carbolic acid, coal tar, or petroleum; the stalls may be deluged with boiling water and afterwards painted with oil or turpentine and littered with fresh pine sawdust, and all blankets should be boiled.

The chigoe or chigger flea, (*Tunga penetrans*) is still more injurious, because it burrows under the surface and develops to the size of a small pea. The tumor formed by it should be laid open and the parasite extracted. This can be done more easily a day or two after its entrance into the skin than on the first day. It is best enucleated by means of a blunt pin or some similar instrument.

LICE (PEDICUL)

Two kinds of lice attack the horse, one of them having a narrow head and a proboscis for perforating the skin and sucking the blood, and the other—the broad-headed kind—having strong mandibles with which it bites the skin. Poor condition, itching, and loss of hair should lead to the suspicion that lice are present, and a close examination will usually disclose the lice. They may be destroyed by rubbing the horse's skin with sulfur ointment, or with potassium sulfide, 4 ounces in water, 1 gallon, or with coal-tar-creosote preparations, or the skin may be sponged with benzine. The application should be repeated 10 to 12 days later to destroy all lice hatched from the nits in the interval. When only biting lice are present, one treatment with a mixture of commercial sodium fluoride, 1 part, and flour, 5 parts, thoroughly dusted into the skin, will destroy all the biting lice present. The sodium fluoride may be used without the flour or may be used in solution, as a spray, at the rate of 1 ounce to 1 gallon of water. Sodium fluoride should not be applied to, or in the vicinity of, the mucous surfaces, such as the mouth, vulva, or anus, as it may cause considerable irritation. Properly used, it is a valuable substance for controlling biting lice in winter, the time when they are most prevalent and annoying. A mixture of 1 percent of derris powder, containing 5 percent of rotenone, in kaolin is effective for the destruction of biting lice. It is advisable to dip twice for lice in the fall, in order to avoid having to apply treatments under the unfavorable conditions prevailing in winter.

STINGS OF BEES, WASPS, AND HORNETS

These are much more irritating than the bites of flies, partly because the barbed sting of bees is left in the wound, and partly because of the quantity and quality of the venom. When a swarm attacks an animal the result may be fatal.

Treatment consists in the application of wet clay, or of a lotion of soda or ammonia, or of carbolic acid, or permanganate of potash, 2 grains to the ounce; or of sugar of lead 2 drams and water 1 pint. The embedded stings should be extracted with fine forceps or even with the finger nails.

TARANTULA AND SCORPION

The bite of the first and the sting of the second are poisonous and may be treated like other insect venom by carbolated glycerin, or a strong solution of ammonia, or permanganate of potash.

SNAKE BITES

These are marked by the double incision caused by the two fangs' by the excessive doughy (dark red) swelling around the wounds, and in bad cases by the general symptoms of giddiness, weakness, and prostration. They are best treated by drenching with strong coffee or aqua ammonia very largely diluted in water, the object being to sustain life until the poison shall have spent its power. As local treatment, if the wound is in a leg, the latter may have a handkerchief or cord tied around it above the injury and drawn tight by a stick twisted into it. In this way absorption may be checked until the poison can be destroyed by the application of a hot iron or a piece of silver nitrate or other caustic. A poultice of tobacco leaves is a favorite remedy and may be used to soothe the sore after cauterization.

A treatment that has been highly recommended consists in prompt and vigorous scarification at the site of puncture and rubbing crystals of potassium permanganate into the wound.

BURNS AND SCALDS

These subjects are discussed in the chapter, Wounds and Their Treatment.

WOUNDS OF THE SKIN

Wounds of the skin are fully discussed in the chapter, Wounds and Their Treatment.

Wounds and Their Treatment

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DESCRIPTION AND GENERAL TREATMENT OF WOUNDS

A wound is an injury to any part of the body, generally caused by violence, with or without laceration of the skin. Wounds may be classified as incised, punctured, lacerated or contused, bruises, wounds of the tendon sheaths, gunshot wounds, poisoned wounds, harness galls, and burns and scalds. Wounds may be further classified as superficial, deep, or penetrating; as unclean, if hair, dirt, or splinters of wood are present; as infected when contaminated with germs; and as aseptic if the wound does not contain germs.

An incised wound is a simple cut made with a sharp object, such as a knife, producing merely a division of the tissues. The duller the object the more force is required, the more tissues destroyed, and the greater the time required for healing. In a cut wound the edges are even and definite, whereas those of a lacerated wound are irregular and torn. Three conditions are normally present as a result of an incised wound: (1) Pain, (2) hemorrhage, (3) gaping of the wound. The first pain is due to the crushing or tearing of the nerve fibers. In a wound made by a sharp knife or other instrument, the animal suffers less pain and healing occurs more rapidly than when a dull instrument is used. The secondary pain is usually due to the action of the air and inflammatory processes. When air is kept from the wound pain ceases soon after the lesion is produced. Hemorrhage is absent only in wounds of tissues containing no blood vessels, as the cornea of the eye, the cartilage of joints, and other similar structures. Bleeding may be from the arteries, veins, or capillaries. In the last form of bleeding the blood oozes from the part in drops. Hemorrhage from the veins is dark red and issues in a steady stream without spurting. In arterial bleeding the blood is bright red and spurts with each heart beat. This latter variety of hemorrhage is the most dangerous and should be stopped at once before attempting any further treatment. Bleeding from small veins and capillaries ceases in a short time spontaneously, whereas larger vessels, especially arteries, require some form of treatment to cause complete stoppage of the hemorrhage.

When a wound causes severe hemorrhage, the first step to be taken is to check the flow of blood. This may be accomplished by several

methods, such as compress bandages, torsion, hot iron, and ligatures. The heat from a hot iron will cause the immediate clotting of the blood in the vessels, and this clot is further supported by the production of a scab, or crust, over the portion seared. The iron should be at a red heat. If at a white heat, the tissue is charred, which makes it brittle and the bleeding is likely to be renewed. If the iron is at a black heat, the tissue will stick to the iron and will pull away from the surface of the wound. Cold water and ice bags quickly stop capillary bleeding, whereas hot water is preferable in more excessive hemorrhages. Some drugs, called styptics, possess the power of contracting the walls of blood vessels and also of clotting the blood. A solution of ferrous chloride placed on a wound alone or by means of cotton drenched in the liquid produces a rapid and hard clot. Tannic acid, alum, acetic acid, alcohol, and oil of turpentine are all more or less active in this respect.

To check bleeding from large vessels compression may be adopted. When bleeding is rapid and dangerous and from an artery, the fingers may be used for pressing between the wound and the heart (digital compression), but if from a vein, the pressure should be exerted on the other side of the wound. Tourniquet may also be used by passing a strap around the part and tightening after placing a pad over the hemorrhage. The rubber ligature has now replaced the tourniquet and is bound tightly around the leg to arrest the bleeding. Tampons, such as cotton, tow, or oakum, may be packed tightly in the wound and then bandaged tightly. After remaining there for 24 or 48 hours they are removed. Bleeding may be easily checked sometimes by passing a pin under the vessel and by taking a silk thread and forming a figure 8 by running it above and below the pin, thus causing pressure on the vessel. Torsion is the twisting of the blood vessel until the walls come together and form a barrier to the flow of blood. It may be accomplished by the fingers, forceps, or by running a pin through the vessel, turning it several times, and then running the point into the tissue to keep it in a fixed position.

Ligation is the third method for stopping a hemorrhage. The blood vessel should be seized with the artery forceps, a clean thread of silk passed around it, and tied about one-half inch from its end. The silk should be sterilized by placing it in an antiseptic solution so as not to impede the healing process or cause blood poisoning or lockjaw, which often follows the ligation of a vein with unsterilized material. Sometimes it will be impossible to reach the bleeding vessel. It is then necessary to pass the ligature around a mass of tissue which includes the blood vessel. Ligation is the most useful method of arresting hemorrhage, since it disturbs healing least and gives the greatest security against secondary hemorrhage.

INCISED WOUNDS

An incised wound is one with clean-cut edges and may be either superficial or deep. In wounds of all descriptions there is necessarily more or less bleeding, and this is especially likely to be the case in incised wounds, particularly when they penetrate to a considerable depth, or when inflicted on a part where blood vessels of any considerable size approach the surface. To arrest the hemorrhage must therefore be the first consideration. If slight, the generous use of cold water is all that is necessary, but if one or more vessels of any size have been wounded or entirely severed, they should be taken up and ligated. If the blood flows continuously and is dark in color, it proceeds from a vein, but if bright colored and jerky in its flow, it is arterial.

The bleeding being arrested, the operator can now carefully clean and inspect the wound, taking care to remove all blood and foreign matter, and clip the hair around the edges before proceeding to stitch it. If the wound is superficial, its lips may be brought together by a series of independent stitches about one-half to three-fourths of an inch apart. The stitches should not be drawn tightly; it is sufficient to bring the edges of the wound together.

If the wound is deep, the needle should be introduced perpendicularly at as great a distance from the lip of the wound as the depth it is to be inserted, to give the thread sufficient hold. All the stitches should be as nearly as possible at equal distances from the border of the wound, to prevent unequal strain, and the knots should be made at the side, not over the wound. When the wound is large and deep, care should be taken to have an opening in the lowest part to allow the escape of the discharges.

In deep wounds that run crosswise of a muscle, it is often advisable to use what is technically known as the "quilled suture." To accomplish this method a curved needle with an eye in the point and a strong double thread should be used. The needle thus threaded is introduced perpendicularly at least an inch from the wound on one side, carried across below, and brought out the same distance from the border of the cut on the opposite side, the thread being seized and held in position while the needle is withdrawn, leaving a loop of thread protruding on one side and two loose ends on the other side of each stitch. When enough stitches have been made, take a light piece of wood about the size of a lead pencil, corresponding in length to the size of the wound or slightly longer, and insert it through each of the loops, drawing up the free ends of the threads, which should in turn be tied securely on a similar piece of wood on that side.

PUNCTURED WOUNDS

Punctured wounds are produced by the penetration of a sharp or blunt-pointed object, such as a thorn, fork, or nail. The orifice of these wounds is small in proportion to their depth. In veterinary practice punctured wounds are much more common than the others. Such wounds involve the feet most frequently, next the legs, and often the head and face from nails protruding through the stalls and trough. Punctured wounds are not only the most frequent, but they are also the most serious, owing to the difficulty of obtaining thorough disinfection and the lack of attention soon after the wound is inflicted. The external wound is so small that little or no importance is attached to it, yet in a short time swelling, pain, and acute inflammation, often of a serious character, are manifested.

WOUNDS OF THE FEET

The most common of the punctured wounds are those of the feet. Horses worked in cities, about iron works, and around newly constructed buildings are most likely to get nails in the feet. The animal treads in nails, pieces of iron, or screws, forcing them into the soles of the feet. If the nail, or whatever it is that has punctured the foot, is fast in some large or heavy body, and is withdrawn as the horse lifts its foot, lameness may last for only a few steps; but unless properly attended to at once the animal will be very lame in the injured member in a day or two. If the foreign body remains in the foot, the animal gradually grows worse from the time of puncture until the cause is discovered and removed. If, when shoeing, a nail is driven into the "quick" (sensitive laminae) and allowed to remain, the horse gradually evinces more pain from day to day; but if the nail has at once been removed, lameness does not, as a rule, show itself for some days; or, if the nail is simply driven "too close," not actually pricking the horse, it may not show any lameness for a week or even much longer. Considering how thin the walls of some feet are, the uneasiness of many horses while being shod, the ease with which a nail is diverted from its course by striking an old piece of nail left in the wall, or from the nail itself splitting, the wonder is not that so many horses are pricked or nails driven "too close," but rather that many more are not so injured. It is not, by any means, always carelessness or ignorance on the part of the blacksmith that accounts for this accident.

From the construction of the horse's foot (being incased in an impermeable, horny box), and from the elasticity of the horn closing the orifice, punctured wounds of the feet almost always produce lameness. Inflammation results, and as there is no relief afforded by swelling and no escape for the product of inflammation, the pus

burrows between the sole or wall and the sensitive parts within it until it generally opens "between hair and hoof." It can thus be seen why pain is so much more severe than when other parts of the body are involved, why tetanus (lockjaw) more frequently follows wounds of the feet, and why, from the extensive, or at times complete, separation and "casting" of the hoof, these wounds must always be regarded with grave apprehension. (See cause and treatment of tetanus.)

Symptoms and treatment.—An excellent practice—that of picking up each foot, cleaning the sole, and thoroughly examining the foot each time the horse comes into the stable—will enable one to reduce to the minimum the serious consequences of punctured wounds of the feet. If the wound has resulted from pricking, lameness follows soon after shoeing; if from the nails being driven too close, it usually appears 4 to 5 days or a week afterward. It is a good plan to inquire as to the time of shoeing, examine the shoe carefully, and see whether it has been partially pulled and the horse has stepped back on some of the nails or the clip. The pain from these wounds is excessive; the horse is seen to raise and lower the leg or hold it from the ground altogether; often the animal points the foot, flexes the leg, and knuckles at the fetlock. Swelling of the fetlock and back tendons is also frequently seen and is likely to cause an improper diagnosis. The foot must be examined carefully, and this can best be done after removing the shoe. The nails should be drawn separately and examined carefully. If there is no escape of pus from the nail holes, or if the nails themselves are not moist, the examination of the foot must be continued by carefully pinching or tapping it at all parts. With a little practice one can detect the spot where pain is the greatest or discover the delicate line or scar left at the point of entrance of the foreign body. The entire sole should then be thinned, after which carefully cut down upon the point where pain is greatest on pressure, and, finally, through the sole at this spot. When the pus has escaped, the sole, as far as it was undermined by pus, should be removed. The foot must now be poulticed for 1 or 2 days and afterward dressed with a compress of oakum saturated with carbolic acid solution or other antiseptic dressing.

If a nail or other object is discovered in the foot, the proper procedure after the offending body is removed is to cut away the sole, in a funnel shape, down to the sensitive parts beneath. This is imperative, and if a free opening has been made and is maintained for a few days, and hot fomentations and antiseptic dressings applied the cure is usually simple, quick, and permanent. The horse should be shod with a leather sole under the shoe, first of all applying tar and oakum to prevent any dirt from entering the wound. In some

instances nails may puncture the flexor tendons, the coffin bone, or enter the coffin joint. Such injuries of the feet are always serious, their recovery slow and tedious, and the treatment so varied and difficult that the services of a veterinarian are advisable.

WOUNDS OF JOINTS

These wounds are more or less frequent. Among horses, such wounds are always serious, and often result in ankylosis (stiffening) of the joint or the death of the animal. The joints mostly punctured are the hock, fetlock, or knee, though other joints may, of course, suffer this injury. As the symptoms and treatment are much the same for all, only the accident as it occurs in the hock joint will be described. Probably the most common mode of injury is from the stab of a fork, but it may result from the kick of another horse that is newly shod, or in many other ways. At first the horse evinces only slight pain or lameness. The owner discovers a small wound scarcely larger than a pea and may pay but little attention to it. In a few days, however, the pain and lameness become excessive; the horse can no longer bear any weight on the injured leg; the joint is very much swollen and painful on pressure; there are well-marked symptoms of constitutional disturbance—quick pulse, hurried breathing, high temperature, 103° to 106° F., the appetite is lost, thirst is present and the horse reeks with sweat. The animal may lie down, though mostly it persists in standing, and the opposite leg becomes greatly swollen from bearing the entire weight and strain for so long a time. The wound, which at first appeared insignificant, is now constantly discharging a thin, whitish or yellowish fluid—joint oil or water, which becomes coagulated about the mouth of the wound and adheres to the part in clots like jelly, or resembling somewhat the white of an egg. Frequently the joint opens at different places, discharging at first a thin, bloody fluid that soon assumes the character just described.

Treatment.—This is very difficult and unsatisfactory. One can do much to prevent this array of symptoms if the case is seen early—within the first 24 or 48 hours after the injury; but when inflammation of the joint is once established the case becomes grave. Whenever a punctured wound of a joint is noticed, even though apparently of small moment, a blistering agent should be applied over the entire joint. Fill also the orifice of the wound. This treatment is almost always effective. It cures in two ways—first, the swelling of the skin and tissues underneath it completely closes the wound and prevents the ingress of air; second, by the superficial inflammation established it checks all deep-seated inflammation. In most instances, if begun soon after the accident, this treatment is very effective in about

1 week; but should the changes described as occurring later in the joint have already taken place, it is then necessary to treat the wound with cooling astringent lotions. A bandage should be applied to hold these applications in place and removed only when swelling of the leg or increasing febrile symptoms make it necessary. In the treatment of open joints the chief aim must be to close the orifice as soon as possible. For this reason repeated probing or even injections should not be made. The only probing of an open joint that is to be sanctioned is on first observation, when the wound should be carefully examined for foreign bodies or dirt, and after removing them the probe must not again be used. The medicines used to coagulate the synovial discharge are best simply applied to the surface of the wound, on pledgets of tow, and held in place by bandages. Internal treatment is also advisable in those cases of open joints in which the suffering is great. At first a light physic should be given and followed with sedatives and anodynes.

LACERATED WOUNDS

Lacerated wounds are those that have been torn and the surrounding tissues bruised to a greater or less extent. Although at first sight such wounds may not appear to be so serious as incised wounds, they are commonly very much more so. Lacerations when extensive are always dangerous. Many horses die from septic infection as a result of these injuries. If the laceration is complicated by severe contusions there is an infiltration of blood into the surrounding tissues; disorganization and death of tissue follow and involve often the deeper-seated structures. Abscesses, single or multiple, may also result and require special treatment.

In lacerated wounds the amount of hemorrhage is usually considerable; even very large blood vessels may be torn apart without inducing a fatal result. The edges of the wound are ragged and uneven. These wounds produced by barbed wire or some blunt object, as when a horse runs against a fence, board pile, or other object.

Treatment.—Great care must at first be exercised in examining or probing to the very bottom of the rent or tear, to see whether any foreign body is present. Often splinters of wood or bits of stone or dirt are thus lodged and unless removed prevent the wound from healing; or if it should heal, the wound soon opens again, discharging a thin, gluey, pus that is characteristic of the presence of some object in the part. After a thorough exploration these wounds should be carefully fomented with warm water, to which has been added carbolic acid in the proportion of 1 part to 100 of water. Rarely, if ever, are stitches to be inserted in lacerated wounds. The surrounding tissues

and skin are so weakened in vitality and structure by the contusions that stitches will not hold; they only irritate the parts. It is better to endeavor to close the wound by means of bandages, plasters, or collodion. One essential in the treatment of lacerated wounds is to provide a free exit for the pus. If the orifice of the wound is too high, or if pus is found to be burrowing in the tissues beneath the opening, make a counter opening as low as possible. This will admit of the wound being thoroughly washed out, at first with warm water, and afterwards with some mild astringent and antiseptic wash. A dependent opening must be maintained until the wound ceases to discharge. Repeated hot fomentations over the region of lacerated wounds afford much relief and should be applied continuously.

BRUISES

Bruises are merely wounds in which the skin has not been ruptured. There are often considerable disintegration of the parts under the skin, subcutaneous hemorrhage, etc., which may result in local death (mortification) and sloughing of the bruised parts. If the bruise is not so severe, many cases are cured quickly by constant fomentation with hot water for 2 to 4 hours. By this time the water should be allowed to become cool gradually and then cold. Cold fomentation must then be kept up for another hour or two. The parts should be thoroughly and quickly dried and bathed freely with an antiseptic solution. A dry, light bandage should then be applied, the horse allowed to rest, and if necessary the treatment repeated each day for 2 or 3 days. If however, the wound is so severe that sloughing must ensue, it should be encouraged by application of poultices. Charcoal may be sprinkled over the surface of the poultice when the wound is bad smelling. After the slough has fallen off the wound may be dressed with warm antiseptic washes. If the wound begins to granulate (fill up) too fast, use burnt alum or air-slaked lime. Besides this local treatment, the constitutional symptoms of fever and inflammation require measures to prevent or control them. This is best done by placing the injured animal on soft or green feed. A physic may be given as soon as possible after the accident. Sedatives also may be administered. When the symptoms of fever are abated, and if the discharges from the wound are abundant, the strength of the patient must be supported by good feed and tonics.

WOUNDS OF THE TENDON SHEATHS

Wounds of tendon sheaths are similar to open joints in that there is an escape of synovial fluid, "sinew water." If the tendons are simply punctured by a thorn, nail, or fork, it is necessary, after a thorough examination of the wound for any remaining foreign substance, to treat with astringent antiseptics and bandages, as for open-joint wounds.

Should the skin and tendons be divided the case is even more serious and is often incurable. There is always a large bed of granulations (proud flesh) at the seat of injury, and a thickening more or less pronounced remains. When the back tendons of the leg are severed a high-heel shoe should be applied which is to be gradually lowered as healing advances. In addition, the parts should be bandaged firmly with a compress moistened with an astringent antiseptic solution. When proud flesh appears it is best kept under control by repeated applications of a red-hot iron. Mares that are valuable as brood animals and stock horses should always be treated for this injury, as, even though blemished, their value is not seriously impaired. If the animal is old and comparatively valueless, the length of time required and the expense of treatment scarcely justify attempting a cure.

GUNSHOT WOUNDS

These wounds vary in size and character, depending on the size and quality of the projectile and also the tissue injured. They are so seldom met with in animals that an extended reference to them seems unnecessary. If a wound has been made by a bullet, a careful examination should be made to ascertain whether the ball has passed through or out of the body. If it has lodged, it will be necessary to probe for it and to remove it when practicable. Oftentimes a ball may be so lodged that it cannot be removed, and it then may become encysted and remain for years without giving rise to any inconvenience. It is often difficult to locate a bullet, as it is readily deflected by resistances met with after entering the body.

The entering wound is the size of the projectile, the edges are inverted and often scorched. The wound produced in case of the bullet's exit is larger than the projectile, the edges are turned out and ragged. A bullet heated by the friction of the barrel or air often softens and become flattened on striking a bone or other tissue. Modern bullets that have an outer steel layer pass through bone without splintering it. Lead bullets may split and produce two exit wounds. Spent bullets may produce only a bruise. Should bones be struck by a ball they are sometimes shattered and splintered to such an extent as to warrant having the animal destroyed. A gunshot wound, when irreparable injury has not been done, should be treated the same as punctured wounds, that is, stopping the hemorrhage, removing the foreign body if possible, and applying hot fomentations or poultices to the wound until suppuration is fairly established. Antiseptic and disinfectant injections may then be used. Should pus accumulate in the tissues, openings must be made at the most depending parts for its escape. Wounds from shotguns fired close to the animals are serious. They are virtually lacerated and contused wounds. Remove all the shot possible from the wound and treat

as directed for contusions. When small shot strike the horse from a distance they stick in the skin or only go through it. The shot grains must be picked out, but as a rule this "peppering" of the skin is not serious.

POISONED WOUNDS

These injuries are the result of bites of snakes, stings of bees, wasps, and other insects. A single sting is not dangerous, but an animal is often stung by a swarm of insects, when the chief danger occurs from the swelling produced. If the animal is stung about the head, the nostrils may be closed as a result of the swelling, causing labored breathing and possibly asphyxiation. Intoxication may be produced by the absorption of this poison and is manifested by staggering gait, spreading of the legs, paralysis of the muscles, difficult respiration, and a rise of temperature. Death may follow in 5 to 10 hours.

Treatment.—Douse the animal with cold water and apply any alkaline liquid, such as soapsuds, sodium bicarbonate, or weak solution of ammonia. Internally give alcohol, ether, or camphor to strengthen the heart. In case of bites by rattlesnakes, moccasins, or other poisonous snakes, a painful swelling occurs about the bitten part, which is followed by labored breathing, weakness, retching, fever, and possibly death from collapse. The animal usually recovers if it can be kept alive over the third day. In treating the animal, a tight ligature should be passed about the part above the wound to keep the poison from entering the general circulation. Wash out the wound thoroughly with antiseptics and then apply a caustic, such as silver nitrate, or burn with a hot instrument. Cold water may be applied to the wound to combat the inflammation. Bites of rabid dogs produce an infected wound, and the virus of rabies introduced in this manner should be removed or destroyed in the wound. (See Rabies, under Diseases of the Nervous System.)

HARNESS GALLS (SITFASTS)

Wounds or abrasions of the skin are frequently caused by ill-fitting harness or saddles. When a horse has been resting from steady work for some time, particularly after being idle in a stable on a scanty allowance of grain, as in winter, the animal is soft and tender and sweats easily when put to work again. In this condition it is likely to sweat and chafe under the harness, especially if this is hard and poorly fitted. This chafing is likely to cause abrasions of the skin and thus pave the way for an abscess or for a chronic blemish, unless attended to very promptly. Besides causing the animal considerable pain, chafing, if long continued, leads to the formation of a callus. This may be superficial, involving only the skin, or it may be deep-seated, involving the subcutaneous fibrous tissue and sometimes the

muscle and even the bone. This causes a dry slough to form, which is both inconvenient and unsightly. Sloughs of this kind are commonly called sitfasts and, although they occur in other places, are most frequently found under the saddle. (See also p. 445.)

Treatment.—Harness galls are best prevented by bringing the animal gradually into working shape after it has had a prolonged rest, in order that the muscles may be hard and the skin tough. The harness should be well fitted, neither too large nor too small, and it should be cleaned and oiled to remove all dirt and to make it soft and pliable. Saddles should be properly fitted to prevent direct pressure on the spine, and the saddle blankets should be clean and dry. Parts of the horse where chafing is likely to occur, as on the back under the saddle, should be cleaned and brushed free of dirt.

The remedies for simple harness galls are numerous. Among them are alcohol, 1 pint, in which are well shaken the whites of two eggs; a solution of silver nitrate, 10 grains to the ounce of water; carbolic acid, 1 part in 15 parts of glycerin. Any simple astringent wash or powder will be effective, provided the sores are not irritated by friction.

If harness galls have developed, the dead hornlike slough must be carefully dissected out and the wound treated carefully with antiseptics. During treatment it is always best to allow the animal to rest, but if this is inconvenient care should be taken to prevent injury to the abraded or wounded surface by padding the harness so that chafing cannot occur.

BURNS AND SCALDS

These wounds of domestic animals are fortunately of rare occurrence; however, when they do occur, if at all extensive, they are troublesome and in many cases are fatal. According to the severity of the burn, there are three degrees: First degree, which is a simple reddening of the skin; second degree, a formation of vesicles, or blisters; third degree, a complete destruction of vitality of the tissues, such as would occur in charring from direct contact with flames or from escaping steam. Besides the burns caused by flames and steam, there are other causative agents, such as chemicals (caustic alkalies and acids), lightning stroke, and occasionally the broken wires of an electric system. When a large surface of the skin is burned or scalded, the animal (if it does not die at once from shock) will soon show signs of fever—shivering, coldness of the extremities, weakness, restlessness, quick and feeble pulse, and labored breathing. No matter which agent is a factor in the production of burns, the lesions are practically of the same nature. The extent and site of the burn should lead one in the determination and course of treatment. Burns of the shoulder and those about the region of the elbow or other parts where there is much

movement of the tissues are grave, and, if at all extensive, treatment should not be attempted, but the animal should be killed immediately. A burn of the third degree, in which there is a destruction of the vitality of large areas of tissue, even on parts not subject to much motion, is extremely tedious to treat. In fact, it is questionable whether the treatment and keep of the animal will ever be compensated for, even though recovery does take place. This, in any event, will require at least 6 to 8 weeks. Burns caused by lightning stroke and electric wires are likely to occur in irregular lines, and, unless death occurs at once they generally are not serious.

Treatment.—Treatment should be prompt and effective. If the burns are extensive, the constitutional symptoms should be combated with black coffee or other stimulants to prevent shock. In the local treatment, to alleviate the pain, the application of cold water is recommended. In burns of the first degree, in which there is only a superficial inflammation, a soothing lotion or ointment is very good. Carron oil (limewater and linseed oil, equal parts) is a standard remedy, but a modification composed of linseed oil and limewater each 200 parts, sodium bicarbonate 100 parts, and thymol 1 part, is perhaps better. The scorched surface should be covered with this liniment and then with a layer of borated gauze or absorbent cotton, to protect from the air. The application should be frequently renewed. Carbolated petrolatum may be used in place of the above.

In burns that involve a large area of the body, the affected parts may be gently swabbed with a half-percent aqueous tannic acid solution and covered with a light gauze bandage. This treatment may be repeated several times, and after a few days the affected area may be treated with antiseptic applications to prevent infection. When the severe inflammation subsides and healing begins, care should be taken to keep the wound clean and dressed frequently with antiseptics.

Burns due to mineral acids may be first treated by flushing the parts with a copious quantity of cold water or by the application of whiting or chalk. Use either a large quantity of water at the beginning or use the chalk first, then wash with water. If the irritant has been a caustic alkali, such as potash, lye, ammonia, or soda, vinegar should be the first application. A veterinarian should be called in all cases of serious burns.

SUTURES

After the bleeding has been controlled and all foreign bodies removed from the wound, the gaping of the wound is noticeable. It is caused by the contraction of the muscles and elastic fibers, and its degree depends on the extent, direction, and nature of the cut. As this gaping will hinder the healing process, it must be overcome by bringing the edges together by some sort of sutures or pins or by a

bandage applied from below upward. As suture material, ordinary cotton thread is good, if well sterilized, as are also, catgut, silk, and various kinds of wire. If the suture is made too tight the subsequent swelling may cause the stitch to tear out. In order to make a firm suture the depth of the stitch should be the same as the distance the stitch is from the edge of the wound. The deeper the suture the more tissue is embraced and the fewer the number of stitches required. In tying a suture the square or reef knot should be used. Closure of wounds by means of adhesive plaster, collodion, and metal clamps is not practiced to any great extent in veterinary surgery of the horse.

PROCESS OF HEALING

In those cases where perfect stoppage of bleeding, perfect proximation of the edges of the wound, and perfect cleanliness are obtained, healing occurs within 3 days, without the formation of granulations, pus, or proud flesh, by what is termed "first intention." If wounds do not heal in this manner they will gap somewhat and become warm and painful. Healing then occurs by granulation or suppuration, which is termed "healing by second intention." The sides of the wound become covered with granulation tissue that may fill the wound and sometimes overlap the lips, forming a fungoid growth called proud flesh. Under favorable conditions the edges of the wound appear to grow together by the end of the first week, and the whole surface gradually becomes dry and finally covered with pigmented skin when the wound is healed.

The cause of pus formation in wounds is the presence of germs. For this reason the utmost care should be adopted to keep clean wounds aseptic, or free from germs, and to make unclean wounds aseptic by using antiseptic fluids to kill the microbes present in the wound. The less the injurious action of this fluid on the wound and the greater its power to kill germs, the more valuable it becomes. All antiseptics are not equally destructive, and some germs are more susceptible to one antiseptic than to another. The most important are compound cresol solution, preferably in a 2-percent solution; carbolic acid in either a 2- or 5-percent solution; iodoform, which acts as an anodyne, stimulates granulation, and checks wound secretion; boric acid in a 4-percent solution, which is useful for cleansing minor wounds and also for washing eyes. In some cases mercuric chloride (1 to 1,000 solution) may be used in treating obstinate wounds, but as this drug is extremely poisonous its use is not advised except in cases that can be given careful attention and the animal prevented from becoming poisoned internally.

Tannic acid is a useful drug in the treatment of wounds, as it arrests hemorrhage, checks secretion, and favors the formation of a scab. A mixture of 1 part tannic acid and 3 parts iodoform is good

in suppurating wounds. More depends on the care and the method of application of the drug than on the drug itself. On aseptic wounds use only those antiseptics that do not irritate the tissue. In order to keep air from the wound and to absorb all wound secretions rapidly, a dressing should be applied. If the wound is aseptic, the dressing should be likewise, such as cotton gauze, sterile cotton, oakum, or tow. This dressing should be applied with uniform pressure at all times and secured by a bandage. Allow it to remain for a week or 10 days if the wound is aseptic or if the dressing does not become loose or misplaced or become drenched with secretions from the wound, or if pain, fever, or loss of appetite does not develop. The dressing should then be removed, the wound treated antiseptically, and a sterilized dressing applied.

HEALING UNDER A SCAB

This often occurs in small superficial wounds that have been kept aseptic. In order that a scab may form, the wound must not gap, secrete freely, or become infected with germs. The formation of scab is favored by astringents and styptics, such as tannic acid or iodoform. In case of fistulous withers, open joints, or other large, hollow wounds that cannot be dressed, antisepsis may be obtained by warm-water irrigation with or without an antiseptic fluid. It should continue day and night and never be interrupted for more than 8 hours, for germs will then have gained headway and will be difficult to remove. Four or five days of irrigation will be sufficient, for granulations will then have formed and pus will remain on the outside if it forms. For permanent irrigation the stream should be very small, or drop by drop, but should play over the entire surface of the wound. It is always better to heal an infected wound under a scab, or treat it as an open wound, than it is to suture it, thus favoring the growth of the enclosed germs and retarding ultimate healing. In the latter case pus may develop in the wound, form pockets by sinking into the tissues, and cause various complications. The pockets should be well drained, either through incisions at the bottom or by drainage tubes. They should then be syringed out frequently or continuously irrigated. In case proud flesh appears it should be kept down either by pressure or by caustics, as powdered bluestone, silver nitrate, chloride of antimony, or by astringents, such as burnt alum. If proud flesh proves resistant to this treatment it may be removed by scissors, the knife, or by searing with the hot iron. The following rules for the treatment of wounds should be followed: (1) See that the wound is clean; for removing foreign bodies, use a clean finger rather than a probe; (2) all hemorrhage should be arrested before closing the wound; (3) antiseptics should be used only if it is suspected that the wound is infected; (4) when pus is present treat without

closing the wound, which may be accomplished by drainage tubes, absorbent dressings, setons, or continuous irrigations; (5) protect the wound against infection while healing.

GANGRENE

Gangrene denotes the death of the affected part and mostly attacks soft tissue near the surface of the body. Gangrenous areas may occur as a result of shutting off their blood supply. Constitutional diseases, such as ergotism, anthrax, and septicemia, predispose to gangrene. External causes include acids and alkalies, freezing and burning, contusions and continuous pressure that interrupt the circulation. There are two forms of gangrene—dry and moist. Dry gangrene is most often seen in horses from continuous lying down (decubitus) or from uneven pressure of some portion of the harness.

Symptoms.—There is a lack of sensation due to the death of nerves. In dry gangrene the skin is leathery and harsh, whereas in moist gangrene the tissues are soft, wrinkled, and friable; the hair is disturbed, and the skin is usually moist and soapy and sometimes covered with bubbles. The tissue surrounding the moist gangrenous patch is usually inflamed, swollen, and hot, but this is less noticeable in dry gangrene. Moist gangrene often spreads and involves deeper tissue, sheaths of tendons, and joints, producing septic synovitis or septic arthritis leading to pyemia and death. Dry gangrene is seldom dangerous, but the rapidity of its spread will indicate its virulence.

Treatment.—The preventive treatment consists in avoiding all the influences that tend to disturb the nutrition of the tissues, such as excessive cold or heat or continuous pressure. Gangrene following decubitus may be prevented by using soft bedding and frequently turning the animal from one side to the other. In dry gangrene moist heat in the form of poultices or the application of oils and fats will be beneficial in hastening the dead tissue to slough off. When the outer skin begins to suppurate, it should be removed with a pair of pincers, and the patch treated as an open wound. In moist gangrene the tissue may be thoroughly disinfected with a 3-percent solution of compound cresol solution. Continuous irritation with antiseptic fluids prevents the accumulation and absorption of poisonous liquids. Incisions into the dead tissue may be made, and when sloughing commences the tissue should be removed with forceps and the resulting wound treated as in dry gangrene.

ULCERATION

An ulcer is a circumscribed area of necrosis occurring on the skin or mucous membrane and covered with granulation tissue. It is a process of destruction, and when this process is going on faster than

regeneration can take place, a gnawing, or eating, ulcer occurs. When such an ulcer increases rapidly in size it is termed a phagedenic ulcer. A fungoid ulcer is one in which the bottom of the ulcer projects beyond the edge of the skin. These ulcers secrete milky or bloody-white liquid called ichor. When the ulcer is of an ashen or leaden color, with the bottom and sides formed of dense, hard connective tissue, which gives little discharge and is not sensitive, it is termed callous, torpid, or indolent ulcer.

Causes.—As in gangrene, disturbances of circulation are among the most frequent causes. A wound to a tissue with slight recuperative power may be followed by ulceration, as in tumors. Certain germs may produce ulcers, as the glanders bacilli, which cause the ulcerations on the nasal septum in glanders.

Treatment.—This consists in removing the exciting cause at once. The secretions of the ulcer should be washed off with antiseptic solutions and the formation of granulation tissues stimulated by antiseptic salves, such as carbolated petrolatum, or iodoform ointment. Air should be kept from the ulcer by occlusive dressings. Callous ulcers are best removed by a curette, knife, or hot iron and then treated like a common wound. Mechanical irritation should be avoided.

ABSCESSSES

These consist of accumulations of pus within circumscribed walls, at different parts of the body, and may be classed as acute and cold or chronic abscesses.

When an abscess occurs about a hair follicle it is called a boil or furuncle. When several hair follicles are involved, resulting in the formation of more than one exit for the inflammatory products, it is called a carbuncle.

ACUTE ABSCESSSES

Acute abscesses follow as the result of local inflammation in glands, muscular tissue, or even bones. They are common in the first two. The abscesses most common in the horse (and the ones that are described here) are those of the salivary glands, occurring during the existence of "strangles," or "colt distemper." The glands behind or under the jaw increase slowly in size, become firm, hard, hot, and painful. At first the swelling is uniformly hard and resisting over its entire surface but in a little while becomes soft (fluctuating) at some portion, mostly in the center. From this time on the abscess is said to be "pointing," or "coming to a head," which is shown by a small elevated or projecting prominence, which at first is dry but soon becomes moist with transuded serum. The hairs over this part loosen and fall off, and in a short time the abscess opens, the contents escape, and the cavity gradually fills up—heals by granulations.

Abscesses in muscular tissue are usually the result of bruises or injuries. When abscesses are forming the ripening process may be hastened by frequent hot fomentations and poultices. It is a common rule with surgeons to open an abscess as soon as pus can be plainly felt, but this practice can scarcely be recommended indiscriminately to owners of stock, since this operation frequently requires an exact knowledge of anatomy. The better plan usually is to encourage the full ripening of an abscess and allow it to open of itself. This is imperative if the abscess is in the region of joints. When the abscess is opened, its walls must not be squeezed to any extent. They may be very gently pressed with the fingers at first to remove the clots—inspissated pus—but after this the orifice is simply to be kept open by the introduction of a clean probe, should it be disposed to heal too soon. If the opening is at too high a level another should be made into the lowest portion of the abscess to permit the most complete drainage. Hot fomentations or poultices are sometimes required for a day or two after an abscess has opened and are particularly advisable when the base of the abscess is hard and indurated.

The cavity should be thoroughly washed with stimulating antiseptic solutions, such as 3 percent solution of carbolic acid, 3-percent compound cresol solution, or 1-percent potassium permanganate solution. If the abscesses are foul and bad smelling, their cavities should first be syringed with 1 part of hydrogen peroxide to 2 parts of water and then followed by the injection of any of the previously mentioned antiseptics.

COLD ABSCESSSES

Cold abscesses are large, indolent swellings that are the result of a low or chronic form of inflammation, in the center of which there is a small collection of pus. They are often seen near the point of the shoulder, forming the so-called breast boil. The swelling is diffuse and of enormous extent but slightly hotter than surrounding parts and not very painful on pressure. A pronounced stiffness, rather than pain, is evinced on moving the animal. Such abscesses have the appearance of a hard tumor, surrounded by a softer edematous swelling, involving the tissues to the extent of a foot or more in all directions from the tumor. This diffused swelling gradually subsides and leaves the large, hardened mass somewhat well defined. One of the characteristics of cold abscesses is their tendency to remain in the same condition for a great length of time. There is neither heat nor soreness and no increase nor lessening in the size of the tumor. If, however, the animal should be put to work for a short time, the irritation of the collar causes the surrounding tissues to assume again an edematous condition, which after a few days' rest disappears, leaving the tumor as before or but slightly larger. On careful manipula-

tion what appears to be a fluid deep-seated in the center of the mass may be discovered. The quantity of pus so contained is very small—often not more than a tablespoonful—and for this reason it cannot, in all cases, be detected.

Cold abscesses are mostly, if not always, caused by the long-continued irritation of a loose and badly fitting collar. There is a slow inflammatory action going on, which results in the formation of a small quantity of pus enclosed in very thick and but partially organized walls that are not so well defined as is the circumference of fibrous tumors, which they most resemble.

Treatment.—The means recommended to bring the acute abscess “to a head” are but rarely effectual with this variety; or, if successful, too much time has been occupied in the cure. Other and more rapid methods of treatment must be used. These consist, first of all, in carefully exploring the tumor for the presence of pus. The incisions must be made over the softest part and carried deep into the tumor—to its very bottom, if necessary—and the pus allowed to escape. After this, and whether or not pus is found, an active inflammation of the tumor must be induced in order to promote solution of the thick walls of the abscess. This may be done by inserting well into the incision a piece of oakum or cotton saturated with turpentine, carbolic acid, or tincture of iodine, or the incision may be packed with powdered zinc sulfate and kept plugged for 24 hours. These agents set up a destructive inflammation of the walls. Suppuration follows, and this should now be encouraged by hot fomentations and poultices. The orifice must be kept open, and should it be disposed to heal some of the agents just described must again be introduced. A favored treatment with many, and it is probably the best, is to plunge a red-hot iron to the bottom of the incision and thoroughly sear all parts of the walls of the abscess. This should be repeated after the first slough has taken place if the walls remain thickened and indurated.

It is useless to waste time with fomentations, poultices, or blisters in the treatment of cold abscesses, since though apparently removed by such methods, they almost invariably return when the horse is put to work. Extirpation by the knife is not practicable, as the walls of the tumor are not sufficiently defined. If treated as above directed, and if the animal is properly fitted with a good collar after healing, no trace of the large, unsightly mass will remain.

FISTULAS

The word “fistula” is applied to any ulcerous lesion on the external surface of the body that is connected by ducts, or passages, with some internal cavity. Because of this particular formation the term “fistulous tract” is often used synonymously with the word “fistula.”

Fistulas may exist in any part of the body, but the name has come to be commonly accepted as applicable only to such lesions when found on the withers. Poll evil is a fistula on the poll and in no sense differs from fistulous withers except in location. The description of fistula will apply, then, in the main, to poll evil equally well. Quittor presents the characteristic tubular passages of a fistula and may, therefore, be considered and treated as fistula of the foot. Fistulous passages may also be developed on the sides of the face, through which saliva is discharged instead of flowing into the mouth, and are called salivary fistulas. A dental fistula may arise from the necrosis of the root of a tooth. Again, a fistula is sometimes noted at the umbilicus associated with hernia, and recto-vaginal fistulas have been developed in mares, following difficult parturition. Fistulas may arise from wounds of glandular organs or their ducts, and thus we have the so-called mammary or lachrymal fistulas.

Fistulous tracts are lined with a false, or adventitious, membrane and show no disposition to heal. They constantly afford means of exit to the pus or ichorous material discharged by the unhealthy parts below. They are particularly likely to develop at the withers or poll because of the exposed positions that these parts occupy, and, having once become located there, they usually assert a tendency to further extension, because the vertical and laminated formation of the muscles and tendons of these parts allows the forces of gravitation to assist the pus in gaining the deeper-lying structures and also favors its retention among them.

Causes.—Fistulas follow as a result of abscesses, bruises, wounds, or long-continued irritation by the harness. Among the more common causes of fistula of the poll (poll evil) are chafing by the halter or heavy bridle; blows from the butt end of the whip; the horse striking its head against the hayrack, beams of the ceiling, and low doors. Fistulous withers are seen mostly in those horses that have thick necks as well as those that are very high in the withers; or, among saddle horses, those that are very low in the withers, the saddle riding forward and bruising the parts. In either of these locations severe bruising, ulcers of the skin, or simple abscesses, if not properly and punctually treated, may become fistulas. They are often caused by bad-fitting collars or saddles, by direct injuries from blows, and from the horse rolling upon rough or sharp stones. The bruised or chronically irritated tissues are particularly susceptible to invasion by cocci, and other pus-producing organisms and certain parasites frequently lodge in the deep-lying tissues. The germ, *Brucella abortus*, which causes brucellosis (Bang's disease, infectious abortion), in cattle, is sometimes found in the pus of the lesions. The pus burrows and finds lodgment deep down between the muscles and escapes only when the sinus

becomes surcharged or when, during motion of the parts, the pus is forced to the surface.

Symptoms.—These, of course, will vary according to the progress made by the fistula. Following an injury there is often soreness or stiffness of the forelegs, and on careful examination of the withers small tortuous lines are seen to run from the point of irritation downward and backward over the region of the shoulder. These are superficial lymphatics and are swollen and painful to the touch. In a day or two a swelling is noticed on one or both sides of the dorsal vertebrae, which is hot, painful, and rapidly enlarging. The stiffness of the legs may disappear at this time, and the heat and soreness of the parts may become less noticeable, but the swelling remains and continues to enlarge.

A fistulous ulcer of the poll may be first indicated by the opposition that the animal offers to the application of stable brush or bridle. At this time the parts are so sore and sensitive that there is some danger that unless handled with the greatest care the patient will acquire disagreeable stable habits. The disease in its early stages may be recognized as a soft, fluctuating swelling surrounded by inflammatory swelling, with the presence of enlarged lymphatic vessels and stiffness of the neck. Later the inflammation of the surrounding tissues may disappear, leaving a prominent tumefaction. The swelling, whether situated on the head or the withers, may open and form a running ulcer, or its contents may dry up and leave a tumorlike mass that gradually develops the common characteristics of a fibrous tumor. When the enlargement has opened the pus, which then usually contains many kinds of pus-forming germs, becomes ichorous and causes the loss of hair on the surface over which it flows.

Treatment.—In the earliest stage, when there are soreness and enlarged lymphatics but no well-marked swelling, the trouble may sometimes be overcome by the internal administration of certain tonics and alteratives, together with local treatment. However, the veterinarian does not often have an opportunity to treat the case until the swelling has progressed considerably and pus has accumulated in the process, or fistulous tracts extending deep into the bony and ligamentous structures of the part have formed. In such cases, surgery constitutes the generally preferred treatment. In a few cases incision of the tissues over the deep-seated lesion at its lowest part to permit drainage of the pus and necrotic material may be all that is necessary. However, sooner or later, most cases require a thorough surgical operation. This in most instances necessitates anesthesia, either local or general, and consists in free incision and the removal of all dead tissue, particularly the involved part of the large ligament (ligamentum nuchae), which extends from the spines

of the vertebrae in the region of the shoulder to the poll. Experience and familiarity with the anatomy of the region are essential, and the control of hemorrhage is important. Following the operation, veterinary procedure differs according to the nature of each case. Various antiseptic dressings should be applied regularly, and since much depends on the care given the horse that has been operated on, many veterinarians prefer that the animal be hospitalized so that it may receive expert attention. Drainage must be maintained so that the wound may heal from the bottom and gradually fill in with healthy tissue. Alterative tonics are frequently used in the aftercare of operative cases.

Animals operated on for fistula of the withers and poll evil should not be subjected to work until recommended by the veterinarian. Even after healing has taken place, a period at pasture may be desirable. Considerable time may be required for the cure of fistula by these methods, but they have been found by most veterinary surgeons to be well advised. Such procedures as blistering and firing, the use of caustic drugs and certain other treatments, in addition to being unnecessarily cruel, are often only temporarily beneficial and many times are actually harmful. Following these practices the condition may improve for the time being, only to reappear in more serious form, finally developing into a case that for all practical purposes, is not economical or possible to remedy.

In fistula of the foot, the same tendency occurs toward the burrowing of pus downward to lower structures, or in some cases upward toward the coronet. When a quittor becomes fully established, the lateral cartilages of the foot and even the bone often become necrosed and radical surgery becomes necessary. Prior to the development of a quittor there is always swelling at the coronet, accompanied with heat and pain. Every effort should now be made to prevent the formation of an abscess at the point of injury. Wounds caused by nails, gravel, or any other foreign body that may have lodged in the sole of the foot should be opened at once from below, to allow free exit to all purulent discharges. If the injury has occurred directly to the coronet, cold applications may prove efficient in preventing the formation of an abscess.

After all fragments of diseased tissue have been trimmed away antiseptic solutions are usually injected, and, after the wound is covered with sterile packing saturated with some good antiseptic wash, the whole foot may be carefully covered with clean bandages, which will afford valuable assistance to the healing process by excluding all dirt from the affected part.

Another form of treatment for this class of infection consists in the use of bacterins. Such treatment appears to be well adapted for the purpose and according to many reports has met with success.

These bacterins are composed of several strains of the organisms usually found in these pustular infections of the horse. Two kinds of bacterins are used: First, autogenic bacterins, which consist of heated (killed) cultures of the particular organism or organisms that are causing the trouble and that have been isolated from the lesions in the case being treated; second, stock bacterins, consisting of dead organisms of certain species generally found in these lesions and that are used in diseased conditions caused by one or the other of these germs. The bacterins should be administered by a competent veterinarian.

Infectious Diseases

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GENERAL DISCUSSION

An infectious disease is any malady caused by the introduction into the body of minute organisms of the vegetable or animal kingdom that have the power to multiply indefinitely and set free certain peculiar poisons which are chiefly responsible for morbid changes. Many diseases of animals for which a definite cause may be attributed are caused by bacteria. Among these diseases are tuberculosis, anthrax, blackleg, and tetanus. There are some diseases, as, for instance, cattle-tick fever and dourine, that are caused by minute animal parasites known as protozoa, whereas others, such as actinomycosis and aspergillosis, are caused by fungi. Besides these infective agents there are those known as filtrable viruses. Hog cholera, foot-and-mouth disease, smallpox, equine infectious anemia, infectious encephalomyelitis, and many other diseases are attributed to such agents.

Bacteria are very minute unicellular organisms of plantlike character. They multiply either by simple division or by spore formation, the latter usually taking place when the conditions pertaining to the growth of the bacteria become unfavorable. The spores are much more resistant to destruction than the bacteria that produce them.

A filtrable virus is an infectious agent that will pass through the minute pores of filters specially made to withhold bacteria. Originally the term "virus" was applied by Pasteur to any infective agent. Today the word is usually applied only to filtrable agents. In recent years some viruses that were previously known as filtrable have been found, under proper conditions, to assume the form of minute bacteria. Some such organisms, as for example that of contagious pleuropneumonia in cattle, have been found capable of passing through fine filters and may even be cultivated in the laboratory, like bacteria. Accordingly, at the present time, the term "ultrafiltrable virus" is commonly used to apply to a virus that will pass through a collodion filter with minute pores and that is not visible under the ordinary microscope and may be cultivated in the laboratory only in the presence of living tissue cells.

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Protozoa are more complex than bacteria, and their artificial cultivation is more difficult than that of most bacterial parasites. Of the representatives of this group, causing disease in animals, are the trypanosomes, which are the causative factors of dourine and surra, and the piroplasmata, which induce tick fever in cattle and malaria or biliary fever in horses. There are also disease-producing fungi that are responsible for certain affections in horses. Among these the most important are mycotic lymphangitis, or sporotrichosis, and streptothricosis.

The introduction of infection may take place in various ways. In some diseases it takes place in one way; in others, in another way; in some, in several ways. The entrance of the infection may occur by inhalation, abrasions of the skin or mucous membranes, wounds, insect bites, by way of the mouth, through the genital organs, and at times even through the intact skin or membranes of the body. Infectious diseases have a period of incubation, which comprises the time elapsing between the exposure to the infection and the actual appearance of the disease. This period varies in the different diseases and to some extent with the intensity and method of the exposure and the condition of the exposed animal.

The treatment of infectious disease, when once it becomes fully developed, is often unsatisfactory. When the symptoms have once developed, some diseases are likely to run their course in spite of treatment. If the ailment is one from which animals usually recover, often all that need or can be done is to put them into the most favorable surroundings. All animals with infectious diseases, whether mild or highly fatal, are more or less a menace to others. They represent for the time being manufactories of disease germs; they are giving them off more or less abundantly during the period of sickness and in some cases remain as carriers or reservoirs of infection after they appear to have recovered from the disease. They may infect others directly or through their surroundings, which thus become a future source of infection.

Therefore, in the control of infectious diseases prevention is the most important procedure. The isolation or segregation of healthy animals from infected ones should be primarily considered, and if at any time an animal manifests the symptoms of an infectious disease it is essential to protect the others from such a source of danger. It is good policy always to burn or deeply bury the body of a dead animal, particularly if the disease is infectious. It is generally unwise to permit hogs, dogs, chickens, or other animals to have access to an animal dead from any cause. In some of the infectious diseases it may be advisable to kill the infected animals in order to avoid the spread of the disease. At times when diseases appear in a country where they have not been prevalent, it becomes advisable and necessary to protect the healthy

herds by the slaughter of all the infected animals. Pursuance of this policy has resulted in control of foot-and-mouth disease and contagious pleuropneumonia of cattle, and has proved to be a satisfactory method of eradication of other diseases.

The early recognition of an infectious disease is important in the prevention of spread to other animals and the most effective treatment of individual cases. The prompt attention of a competent veterinarian is therefore of particular importance.

DISINFECTION

Disinfection should have an important place in the control of infectious disease. This consists in the use of certain substances that possess the power to destroy bacteria or their spores, as well as other infectious agents. Among the cheapest and most available for animal diseases are chlorinated lime, carbolic acid, corrosive sublimate, formalin, formaldehyde gas, cresol compounds, lye, and unslaked lime in powder form. Some agents are known to be particularly lethal for one type of germ but much inferior as a disinfectant against another. For other reasons, a preparation may be applicable in one case but inadvisable in another. For example, compound solution of cresol, U. S. P., though a good general disinfectant in 4- to 6-ounce quantities to each gallon of water used, is undesirable where the odor may be imparted to milk and other dairy products. Nearly all disinfectants are poisonous when taken internally and many are strong irritants to the skin and hence must be used with caution.

In the disinfection of stables and premises it is essential that the work be thoroughly done, preferably under direct veterinary supervision. The general principles of disinfection are outlined in the following directions:

1. Sweep ceilings, side walls, stall partitions, floors, and other surfaces-until free from cobwebs and dust.
2. Scrape away all accumulation of filth, and if woodwork has become decayed, porous, or absorbent, it should be removed, burned, and replaced with new material.
3. If the floor is of earth, remove at least 4 inches from the surface, and in places soaked with urine a sufficient depth should be replaced to expose fresh earth. All earth removed should be replaced with earth from an uncontaminated source; it would be still better to lay a new floor of concrete, or other material that is durable and easily cleaned.
4. All refuse and material from stables and barnyards should be removed to a place not accessible to other animals. The manure should be burned or spread on fields. Wood removed from infected premises should be burned.

5. The entire interior of the stable, especially the feeding and watering troughs and drains, should be saturated with the disinfectant. The best method of applying the disinfectant is by means of a strong spray pump, such as those used by orchardists. This method is efficient in disinfection against most of the contagious and infectious diseases of animals, and it, or some other method particularly advised by those responsible for the control of the specific disease, should be used immediately following any outbreak. As a matter of precaution, it may be a good practice to clean and disinfect thoroughly at least once or twice yearly. All stable equipment such as pitchforks, shovels, buckets, and brushes, should be included in the process of disinfection.

6. It is important that arrangements be made to admit a plentiful supply of sunlight and fresh air by providing an ample number of windows, thereby eliminating dampness, bad odor, and other insanitary conditions. Good drainage is also very necessary.

VACCINATION

In recent years vaccination for the prevention of certain infectious diseases has been successfully developed, and without doubt the future has a great deal in store for this phase of prevention. At the present time vaccination against such diseases as tetanus, anthrax, infectious equine abortion, and sleeping sickness of horses are generally approved and universally used. It is essential that the products used for the vaccination be pure and potent; also they should be employed only by or with the supervision of competent authorities, and with proper care. The biological products prepared for the cure and prevention of infections are prepared by manufacturers who, in order to conduct an interstate business, are required to obtain a license from the United States Department of Agriculture for the manufacture of such preparations. Since July 1, 1913, the Department of Agriculture, by an act of Congress of March 4, 1913, has had control of the manufacture of biological products for the treatment of domestic animals. This supervision is of far-reaching importance, as it assures the users that the preparations are reliable.

The laws in some States require that certain of the more or less dangerous biological products used for the prevention of disease must be administered only by trained, licensed veterinarians.

INFLUENZA

Synonyms.—Pinkeye, epizooty, shipping fever; fièvre typhoïde, grippe (French); Pferdestaupe (German).

Definition.—The term "influenza" is applied to a febrile, contagious, infectious disease of horses, which is characterized by a blood infection, with inflammation of the mucous membranes, which frequently involves the lungs. Inflammatory complications also occur in the

form of swellings of the subcutis, tendons, and tendinous sheaths and laminae of the feet. One attack usually protects the animal from future ones of the same disease. For this reason the malady is most common in young animals, attacking older animals only rarely. An apparently complete recovery is sometimes followed by serious sequelae of the nervous and blood-vessel systems. Under certain conditions the disease is likely to assume an epizootic form, with a tendency to complications of certain organs, as, at one period, the lungs, at another the intestines, etc.

The first description of influenza was given by Laurentius Rusius in 1301, when it spread over a considerable portion of Italy, causing great loss among the war horses of Rome and the surrounding district. Later, in 1648, an epizootic of this disease appeared in Germany and spread to other parts of Europe. In 1711, under the name of "*epidemica equorum*," it followed the tracks of the great armies all over Europe, causing immense losses among the horses, while rinderpest was scourging the cattle of the same regions. The two diseases were confounded with each other, and were supposed, by the scientists of the day, to be allied to typhus, which was a plague of the human race at the same time. The first advent of this disease to the British Islands was in an epizootic among the horses of London and the southern counties of England in 1732, which is described by Gibson. In 1758 Robert Whytt recounts the devastation of the horses of the north of Scotland from the same trouble. Throughout the eighteenth century a number of epizootics occurred in Hanover and other portions of Germany and in France, these attacks being renewed early in the present century, with complications of the intestinal tract, which obtained for it the name of gastroenteritis. In 1766 it first attacked the horses in North America but is not described as again occurring in a severe form until 1870-72, when it spread over the entire country, from Canada south to Ohio, and then eastward to the Atlantic and westward to California. During the first World War it was a particularly troublesome disease in the armies of all countries. The hardships of war campaigns and the concentration of large numbers of susceptible horses in remount depots and camps undoubtedly encouraged the disease. With the passing of the large commercial stables in our cities, the disease now emanates from sales stables and stockyards through which animals are passed en route to the farms. Horses congregated at shows and race tracks also commonly contract the disease. With these exceptions, there is less direct contact among horses than in former years. Nevertheless it assumes from time to time an enzootic form, when from some reason its virulence increases. It assumes this form also when, from reasons of rural economy and commerce, large numbers of young and more susceptible animals are exposed to its contagion.

Etiology.—The experiments of Dieckerhoff many years ago proved that the disease may be transmitted to healthy animals by intravenous injection of warm blood from affected horses.

Further investigations revealed the fact that blood from affected horses, even when passed through porcelain filters, may transmit the disease, thereby proving that the causative agent belongs to the so-called filtrable viruses. This has been further substantiated by Gaffky, who showed in his experiments that the disease may be transmitted with defibrinated as well as with filtered blood, in which cases the typical form of influenza developed in inoculated animals in 5 to 6 days. These findings were also substantiated by Basset, and since by many others. Further observations have also proved that apparently recovered animals may harbor the infection for a long time and still be capable of transmitting the disease. Such virus carriers are no doubt responsible for numerous outbreaks of this disease when, in a locality free from the disease, it appears after the introduction of an apparently healthy animal.

As one attack is usually self-protective, numbers of old horses, having had an earlier attack, are not capable of contracting it again. Young horses, especially those about 3 to 5 years of age, are much more predisposed to be attacked, whereas the older ones, even if they have not had the disease, are less liable to it. Overfed, fat, young horses coming from the sales stables appear to be much more susceptible to contagion than the same horses after a few months of steady work. Although the virus is essential for the production of the disease, exposure, chilling, or overwork may increase susceptibility to the disease. After the virus has attacked the body, various kinds of germs may thrive in the diseased tissue, leading to complications.

Symptoms.—After the exposure of a susceptible horse to infection, a period of incubation of 2 to 7 days elapses, during which the animal seems in perfect health, before any symptom is visible. When the symptoms of influenza develop they may be intense or so moderate as to occasion little alarm. In the latter case, the animal frequently is worked or driven out to show to prospective purchasers. This procedure often is an exciting cause of complications that would not have resulted had the animal been left quietly in its stall.

The first symptom is usually a rapidly developing fever, which becomes intense within a short period. The animal becomes dejected and inattentive to surrounding objects, and stands with its head down. Chills lasting 15 to 30 minutes may develop. These are evidenced by trembling and shivering in the flanks, the muscles of the croup, and of the shoulders, or of the entire body. There may be grinding of the teeth. The hairs become dry and rough and stand more or less erect. The body temperature increases to 104°, 104.5°, or 105° F., or even in severe cases to 107°, within the first 12 to 18

hours. The horse becomes stupid, stands immobile with its head hanging, the ears listless, and pays little attention to its stablemates or the surrounding attendants. The stupor becomes rapidly more marked, the eyes become puffy and swollen with excessive lachrymation, so that the tears run from the inner canthus of the eye over the cheeks. The respiration becomes accelerated to 25 or 30 in a minute, and the pulse is quickened to 70, 80, or even 100 and is moderate in volume and force. There is great depression of muscular force; the animal stands limp, as if excessively fatigued. On movement, the horse staggers and shows weakness. The visible mucous membranes of the mouth and other natural openings become of a deep saffron, ochre, or violet-red color. The condition of the conjunctiva recalls the common name for the disease, pinkeye. In some outbreaks there are much more swelling of the lids and weeping from the eye than in others. There is great lessening or total loss of appetite, with an excessive thirst, but in many cases horses of naturally sluggish temperament may retain a certain amount of appetite, but eat slowly and listlessly. There is some irritation of the mucous membrane of the respiratory tract, as shown by discharge of mucus from the nose, and by cough. Pregnant mares may abort.

Following the fever, there often is a tumefaction, or edema, of the subcutaneous tissues at the fetlocks, of the undersurface of the belly, and of the sheath of the penis, which may be excessive. The infiltration is noninflammatory in character and produces an insensibility of the skin like the excessive "stocking" that is seen in debilitated animals after exposure to cold. In ordinary cases the temperature has reached its maximum of 105° or 106° F. in 24 to 48 hours from the origin of the fever. It remains stationary for 3 to 4 days without so much variation between morning and evening temperature as is commonly seen in pneumonia or other serious diseases of the lungs. At the termination of the specific course of the disease, which is generally 6 to 10 days, the fever abates, the swelling of the legs and undersurface of the belly diminishes, the appetite returns, the strength is rapidly regained, the mucous membranes lose the yellowish color that they attain so rapidly at the beginning of the disease, the animal convalesces promptly to its ordinary good condition and health and rapidly regains the large amount of weight that it lost in the early part of the disease. For the first 3 days of the high temperature there is a great tendency to constipation, which is to be counteracted if possible by using laxative feeds or giving mild purgatives. The constipation may be followed by a troublesome diarrhea.

Complications.—The complications consist of congestions, followed by inflammatory phenomena in the various organs of the body, most commonly the intestines, lungs, brain, or vascular laminae of the feet. It is generally believed that these localized complications

are due to the invasion of the tissues by various bacteria. Many of these are commonly present in the air passages, intestines, or other parts of the body and cause inflammation only when the filtrable virus has undermined the natural resistance of the animal. In certain epizootics, 40 to 50 percent of the cases are rendered more serious by complication of the intestines; in other epizootics, a large percentage of cases are complicated by inflammation of the lungs, while at the same time some are complicated by troubles of the other organs. Inflammatory changes of the brain and of the laminae are found in a small percentage of cases in all epizootics.

Enteritis may be ushered in by colic. The animal paws with the forefeet and shows great sensibility of the belly; it turns the head from side to side and may lie down and get up, not with violence, but with care for itself, protecting the surface of the belly from any violence. At first there is usually a decided constipation; the droppings if passed are small and hard and coated with a viscous, varnishlike mucus or even with false membranes. In 36 to 40 hours the constipation is followed by diarrhea. The feces becomes mixed with a sero-mucous exudation, which is followed by suppurative matter. The animal becomes rapidly exhausted, staggers, loses the little appetite that may have remained and has exacerbations of fever. The pulse becomes softer and weaker, the respiration becomes gradually more rapid, and the temperature is about 1° to 1.5° F. higher. If the extensive diarrhea is arrested in 5 to 10 days recovery usually takes place.

If at any time during the course of the fever the animal is worked or exposed to cold or drafts of air, the lungs may become affected. In many cases, however, after 3 to 5 days of the fever, congestion of the lungs commences without any exposure or apparent exciting cause. Unless this congestion of the lungs is soon relieved it is followed by an inflammation constituting pneumonia. This pneumonia, although essentially the same as ordinary pneumonia, differs from it at the beginning by an insidious course. The animal commences to breathe heavily, which is distinctly indicated by the heaving of the flanks, the dilation of the nostrils, and frequently in the swaying movement of the unsteady body. The respirations increase in number, what little appetite remained is lost, the temperature increases from 1° to 2° , the pulse becomes more rapid and at times, for a short period, more tense and full, but the previous poisoning from the specific disease has so weakened the tissues that it never becomes the characteristic full, tense pulse of a simple pneumonia. On percussion of the chest dullness is found over the inflamed areas; on auscultation at the base of the neck over the trachea a tubular murmur is heard. The crepitant râles and tubular murmurs of pneumonia are heard on the sides of the chest if the pneumonia is

peripheral, but in pneumonia complicating influenza the inflamed portions are frequently disseminated in islands of variable size and are sometimes deep seated, in which case the characteristic auscultatory symptoms are sometimes absent. From this time on the symptoms of the animal are those of a grave pneumonia, rendered more severe by occurring in a debilitated animal. The cough is at first hacking and short; later, more full and moist. There is discharge from the nostrils, which may be mucopurulent, purulent, or hemorrhagic. As in simple pneumonia, in the outset this discharge may be "rusty" owing to capillary hemorrhages. The blood is usually mixed with pus, staining it evenly, instead of being mixed with it in the form of clots. At the commencement of the complication the animal may be subject to chills, which may again occur in the course of the disease. If gangrene occurs it is shown by preliminary chills, a rapid elevation of temperature, a tumultuous heart, a flaky discharge from the nostrils, and a fetid breath.

At any time during the course of the disease congestion of the brain may occur, at an early period if the fever has been intense from the outset, but in ordinary cases more frequently after 3 or 4 days. The animal, which has been stupid and immobile, becomes suddenly restless, walks forward in the stall, and presses its head in the corner. If the animal is in a box stall and is moved, it follows the wall with the nose and eyes, rubbing along it until it reaches the corner and again is quiet. It may become more violent and rear and plunge. If disturbed by the entrance of the attendant or any loud noise or bright light, it may stamp with its forefeet and kick with its hind feet. If fastened by a rope to a stake or post, the animal may wander in a circle at the end of the rope. The period of excitement is followed by one of profound coma, in which the animal is immobile, the head hanging and placed against the corner of the stall, the body limp, and the motion, if demanded of the animal, unsteady. Little or no attention is paid to surrounding noises, or even a slap on the surface of the body. The respiration becomes slower, the pulsations are diminished, the coma lasts for a variable time and is usually followed by excesses of violence, after which the two alternate, but if severe the period of coma becomes longer and longer until the animal dies of exhaustion or heart failure. It may die from injuries that occur in the ungovernable attacks of violence.

The feet as well as the brain are predisposed to complications. Congestion takes place in the laminae of the feet. The stupefied animal is roused by excessive pain in the feet and assumes the position of a foundered horse. In some cases the stupor of the animal is so great that there is no evidence of pain, and little or no change of the position of the animal is noticeable. The foot is hot to the touch, and

after a given time the depressed convex sole of typical founder is recognized.

Pleurisy is a rare complication, but when it does occur the first symptoms are the usual ones of depression, rapid pulse, short respiration, increased temperature, subcutaneous edema of the legs and under surface of the belly, and a line of dullness on either side of the chest and an absence of respiratory murmur at the lower part. If it is severe, there may be an effusion filling one-fourth to one-third of the thoracic cavity in 36 to 48 hours.

Pericarditis is an occasional complication of influenza. The first symptoms are chills, elevation of the temperature, and a rapid, thready, and imperceptible pulse. The heart murmurs become indistinct or cannot be heard. A venous pulse may be seen along the course of the jugular veins of the neck. Respiration becomes more difficult and rapid. If the animal is moved the symptoms become more marked or it may drop dead from heart failure.

Peritonitis, or inflammation of the membranes lining the belly and covering the organs contained in it, sometimes takes place. The general symptoms are similar to those of a commencing pericarditis. The local symptoms are those of pain, especially to pressure on the side of the flanks and belly, distention of the latter, and sometimes the formation of flatus, or gas, and constipation.

Other occasional complications are nephritis, hepatitis, purpura hemorrhagica, various chronic inflammations of the structures of the eye, lesions of the heart, roaring, paralysis, inflammation of the flexor tendons and adhesions or contractions of them, and abscesses.

Diagnosis.—The diagnosis of influenza is based on continued fever, with great depression and symptoms of stupor and coma; the rapidly developing, dark-saffron, ocher, yellowish discoloration of the mucous membranes; swelling of the legs and soft tissues of the genitals. When these symptoms have become manifest the diagnosis of a local complication is based on the same symptoms that are produced in the local diseases from other causes, but in influenza the local symptoms are frequently masked or even entirely hidden by the intense stupor of the animal, which renders it insensible to pain. The evidence of colic and congestion, which is followed by diarrhea, indicates enteritis. The rapid breathing or difficulty of respiration points to a complication of the lungs, but the local evidences of lung lesions are frequently hidden. Inflammation of the feet, or founder, complicating influenza is frequently not shown on account of the insensibility to pain on the part of the animal.

It may be difficult to differentiate the symptoms of brain involvement in this disease from those in encephalomyelitis or encephalitis due to other causes. In this connection, the history of each case, the

particular stable, and others in the vicinity should be considered. The same observations may serve to distinguish between influenza and acute infectious anemia, which in many instances may be similar. Contagious pneumonia is, generally speaking, a more severe acute disease than influenza with a distinct crisis in the disease in 5 to 7 days after the onset of symptoms and a higher mortality. Severe cases of influenza may be mistaken for anthrax in the horse. In both there may be stupor, discoloration of the mucous membranes of the eyes, and a certain amount of swelling of the legs and undersurface of the belly. In some cases the differentiation can be made only by means of laboratory examination of the blood. In strangles and horsepox there may be an intensely rosy coloration of the mucous membranes and a full, tense pulse, and although in these diseases there may be depression, there is usually no marked stupor or coma except in severe cases that have lasted for several days. In influenza there is usually no evidence of the formation of pus on the mucous membranes as in the other diseases, except sometimes in the conjunctiva.

Infectious bronchitis, sometimes referred to as contagious cough of horses, is a highly contagious disease that may be confused with influenza. It appears, however, that the two diseases are distinct, though both are caused by filtrable viruses. The chief characteristic of infectious bronchitis is the constant presence of a dry, forceful cough, at first accompanied with fever. Unless the affected animal is worked or unduly exposed to inclement weather, complete recovery usually takes place within a week or 10 days. Abscess of the lymph glands, pneumonia, or pleuritis is infrequently encountered.

In severe pneumonia, profound coma, dark-yellowish coloration of the mucous membranes, and swelling of the undersurface of the belly and legs may be seen, but there are also difficulty of breathing and an acute fever from the outset, and the other symptoms do not occur for several days. In influenza, on the other hand, the characteristic symptoms are evident for several days before the rapid breathing and difficulty of respiration indicate the appearance of the complication. Without the history of these symptoms it is frequently difficult to differentiate a case of influenza of several days' standing, complicated by pneumonia, from a case of severe pneumonia of 5 or 6 days' standing, but from a prognostic point of view it is immaterial, as the treatment of both is similar. The fact that other horses in the same stable or neighborhood have influenza may aid in the diagnosis.

Prognosis.—Influenza is a serious disease chiefly on account of its numerous complications. Uncomplicated influenza is a comparatively simple malady and is fatal in only 1 to 5 percent of all cases. In some outbreaks, however, complications of one kind or another preponderate; in such instances the rate of mortality is much increased.

Alterations.—The chief alteration of influenza occurs in the diges-

tive tract and consists of hyperemia, infiltration, and swelling of the mucous membrane. The tissues throughout the body are stained and of a more or less yellowish hue. There is invariably a congested condition of all the organs, muscles, and interstitial tissues of the body. The coverings of the brain and spinal cord may manifest the congested and discolored condition of the rest of the tissues.

Other alterations depend on the complications. If the lungs have been affected, there are effusions identical in their intimate nature with those of simple pneumonia, but they differ somewhat in their general appearance in not being so circumscribed in their area of invasion. The alterations of meningitis and laminitis are similar to those of sporadic cases of founder and inflammation of the brain.

Treatment.—While the appetite remains the patient may have a moderate quantity of sound hay, good oats, and bran; or even a little fresh clover, if obtainable, may be given in small quantities. Grass, roots, apples, milk, or any other feed of good quality may be offered and, if eaten, allowed freely in small quantities at a time. It is not so important that a special diet shall be observed as that the horse shall eat a moderate quantity of nourishing feed. The horse should have absolute rest and protection against cold, moisture, and drafts and should immediately be placed in a clean, well-ventilated box stall absolutely away from other horses. Regular and frequent grooming is very advantageous. Fresh, lukewarm water should be before the animal at all times. As soon as possible, a competent veterinarian should be called. The treatment given depends on the condition of each case. In general, however, drastic purgatives should usually be avoided. The animal should be blanketed and sometimes the legs hand rubbed and bandaged. The eyes may be bathed with 2-percent solution of boric acid; a mustard plaster or lightly stimulating liniment may be used over the chest wall. Caution should be observed in its use on Thoroughbred or other thin-skinned horses. Small doses of saline cathartics with alkalinizing substances used from the outset, preferably in the feed or water if they can be so given, may serve to stimulate the digestive tract and prevent constipation and its evil results. There is probably no disease in which good nursing is so advantageous as in influenza. Unfortunately some very injurious practices have prevailed among untrained persons in attempting to cure this disease. Such procedures as forcing the suffering animal to inhale the irritating smoke from old leather and other substances are absolutely condemned by competent veterinarians. If medication by inhalation is deemed desirable, the drugs used are sometimes added to hot water, from which the vapors rise. The receptacle containing the fluids may be placed in the manger or feed box below the animal's head, and sometimes a sheet or blanket is thrown over the head as a hood to confine the vapors.

Early in the disease, stimulants such as whisky (2 to 4 ounces) or strong coffee (1 to 2 pints) are sometimes beneficial. Other stimulants are frequently given hypodermically. Blood transfusions are sometimes given. Various chemicals of the sulfonamide group may be advantageous in some cases of complicating pneumonia. The period of convalescence should extend to at least 2 weeks after the horse appears well before the animal is again worked. During this period, various tonics are sometimes advised.

Founder occurring as a complication of influenza is difficult to treat.

It is, unfortunately, frequently not recognized until inflammatory changes have gone on for several days. If it is recognized at once, the application of hot or cold water to the feet is sometimes useful, in conjunction with systemic treatment.

Prevention.—In order to prevent the introduction of the disease it is advisable to isolate newly purchased animals for at least a week. Further, the stabling of healthy horses in sales and feed stables should be avoided as much as possible. At the beginning of an outbreak the disease may be checked by immediate isolation of the affected horses, by taking the temperatures of the healthy animals, and by the segregation of those showing a marked elevation of temperature. The stables, including mangers, feed boxes, water troughs, brushes, and currycombs should be thoroughly cleaned and disinfected. Whenever possible separate attendants for sick and well animals should be provided. Since the disease may be transmitted by breeding, this should be discontinued during an outbreak.

Bacterial vaccines have been prepared for the prevention of this disease and also for its cure, and many veterinarians attest to the beneficial action of these products. The reports indicate that some such vaccines and serums may sometimes exert a favorable influence on the course of the disease, possibly preventing the severe complications that under ordinary conditions are the principal factors in determining the severity of the outbreak.

CONTAGIOUS PNEUMONIA

Synonyms.—Equine pleuropneumonia; Brustseuche (German).

Contagious pneumonia is an acute, contagious disease of horses, mules, and asses, manifesting itself either as a croupous pneumonia or a pleuropneumonia, frequently complicated by necrosis and gangrene of the lung.

Etiology.—Early investigators of this disease incriminated various kinds of micro-organisms as the cause of this affection. Transmission experiments were usually negative with these organisms. This was also the case in attempts to transmit the disease by feeding affected parts of the lungs, intestinal contents, and nasal discharge; likewise by intravenous or subcutaneous injections of blood and of emulsions made from nasal discharge, urine, the lung, and other organs.

The experimental results of Gaffky and Lührs proved that at least at the beginning of the disease the bronchial secretion contains the infection. On killing horses affected with the typical forms of the disease on the third or fourth day of the affection, the air passages were usually found to be filled with a yellowish, tenacious, germ-free secretion with which they succeeded in infecting healthy colts. The virus has not been isolated and cultivated outside the animal body.

Two types of organisms were formerly especially considered to play an important part in the cause of the disease, streptococci, which have been isolated from most cases of the disease, and pasteurellae. Although there is no doubt of the presence of these micro-organisms in most of the cases, their role as a primary cause is now doubted, especially since attempts to transmit the disease with pure cultures of these germs failed to reproduce it in the typical form. They, however, are probably of significance in connection with the pathological changes secondarily occurring in connection with the infection and probably are a determining factor in the course of the disease. They exert their action after the animal has already been attacked by the true virus and then produce the inflammatory changes attributed to these secondary invaders. The prostration of the animal, combined with the staggering movement and lack of coordination of the muscles, caused the disease for a long time to be confounded with influenza, with which at certain periods it certainly has a strong analogy of symptoms, but from which, as from sporadic pneumonia, it can usually be differentiated if the case can be followed throughout its whole course.

Contagious pneumonia is a specific inflammation of the lungs, accompanied with interstitial edema and inflammation of the tissues of these organs and a constitutional disturbance and fever. It causes a profound depression of the nervous system, which may be so great as to cause death. It is often attended with pleurisy and the accumulation of septic fluid in the thoracic cavity, inflammation of the heart or septic complications, which also prove fatal.

The disease occurs principally in camps, sales stables, or other places where animals are frequently added from outside sources and where comparatively large numbers of horses are gathered together. Young, halter-broken horses passing through stockyards may become infected and carry the disease to the farm, or colts may introduce it into racing stables. Experimentally, the incubation period was observed by Gaffky and Lührs to range from 20 to 44 days in horses exposed by contact with diseased animals. Under natural conditions the incubation period appears to be variable, possibly dependent to some extent on the stage of the disease in the animal to which the healthy horses are exposed. In any case the period is usually longer

than that generally observed in the case of influenza. Definite information as to the method of spread of the disease has not been determined. It is generally believed, however, that spread by other means than direct contact between healthy and infected horses is rare.

Symptoms.—According to some observers the animals are generally actually ill for 1 or 2 days before particular attention is attracted. At this time the animal is found not to work so well as normally and to cough occasionally, the temperature being sometimes as high as 105° F. At this time, if the temperatures of other horses in the stable are taken, several otherwise unsuspected animals may be found with a rise in temperature.

The symptoms may develop slowly or rapidly. If slowly, there is fever and the animal occasionally gives a cough that resembles that of a heavy horse affected with a slight chronic bronchitis; it becomes somewhat dejected and dull, at times sleepy, and has a diminished appetite. This condition lasts for several days, or the disease may begin with high fever, and the symptoms described below are severe and develop in rapid sequence. The respiration increases to 24, 30, or 36 to the minute, and a small, running, soft pulse attains a rhythm of 50, 70, or even more beats to the minute. The heart, however, contrary to the debilitated condition of the pulse, beats violently and tumultuously, as it does in anthrax and septic intoxication. The mucous membranes of the eyes and mouth and of the genital organs may be somewhat edematous, and they rapidly assume a dirty, saffron color, at times approaching an ochre, but distinguishable to the experienced observer, from the similar coloration in influenza by the lack of luster belonging to the latter and by the muddy, dull tint, which is characteristic throughout the disease. There may be a nasal discharge but this is not constant. When present, it varies in degree and character with the changes occurring in the diseased lung tissue. In the more severe cases it is usually thick and becomes brownish in color.

Suddenly, without the preliminary râles that precede grave lesions of the lungs in other diseases, the blowing murmur of pneumonia is heard over a variable area of the chest, usually, however, much more distinctly over the trachea at the base of the neck and directly behind the shoulder on each side of the chest. In some cases the evidence of lung lesion can be detected only over the trachea. The lesions of the lungs may be scattered throughout both lungs, involving numerous small areas, or they may be confined to and more or less fully occupy one or two lobes. Occasionally there is a general involvement of both lungs. The body temperature has now reached 104° to 106° F., or in extreme cases even higher. The debility of the animal is great but without the stupefaction or evidence of cerebral trouble, which is more or less constant with such grave constitutional phenomena in influenza or severe pneumonia. The animal is subject to

occasional chills and staggers in its gait. The yellow coloration of the visible mucous membrane is rendered pale by infiltration of the liquid of the blood into the tissues; the pulse may become so soft as to be almost imperceptible, the heart movement and sounds being at the same time exaggerated. The animal loses flesh rapidly, and dropsies of the extremities, of the undersurface of the belly, or of the internal organs may show themselves.

Terminations.—These symptoms may gradually subside after the crisis at 5 to 8 days. With an improved appetite the animal gains strength and its impoverished blood and tissues are built up; the pulse becomes stronger and the heart more regular and less tumultuous; the mucous membranes assume a brighter and more normal color; the difficulty of respiration is removed, and the animal may make a recovery. When death occurs it is usually directly due to heart failure. In some cases it is caused by asphyxia, owing to the great amount of exudation into the lung tissue, or accumulated fluids in the chest cavity, rendering its further function impossible.

Complications.—The pulmonary complications of contagious pneumonia are secondary inflammatory or necrotic changes in the lungs themselves. Suppuration at times takes place in the bronchi and may extend to the lung tissue. In this case mucous râles develop, which are most distinctly heard over the trachea and on the sides of the chest directly behind the shoulders. With the development of the mucous râles, to be heard on auscultation, there is a more purulent discharge from the nostrils, similar to that of a chronic or sub-acute bronchitis. If the inflammation has continued for some time, cavernous râles may be heard, indicating the destruction of a considerable portion of lung tissue and the formation of a cavity. The effect of this process may not be appreciable in the general condition of the animal, except to weaken it still further and add to its debilitated and emaciated condition. Serious complications are common when the disease occurs in large numbers of horses confined in close quarters under generally unfavorable conditions.

When gangrene of the lung develops, there may be a sudden drop in temperature and other temporary indications of improvement. The true nature of such changes becomes evident in 24 hours or less, when the animal becomes extremely depressed, the breath and discharges become increasingly fetid, and death ensues shortly in most cases.

As in most pneumonias, pleurisy is present. When this becomes marked, large quantities of cloudy fluid frequently accumulate in the chest cavity, breathing becomes increasingly difficult, and pain over the ribs is marked.

A serious complication is involvement of the heart muscle. This is shown by a very weak and rapid pulse and great prostration. This

complication nearly always terminates in death. Other complications are inflammation of the kidneys, blood poisoning, congestion of the brain, and inflammation of the tendinous sheaths and the tendons of the legs. Purpura hemorrhagica develops as a sequel in some cases.

Prognosis.—The mortality in this disease may be as high as 50 percent, but it is usually not more than 10 percent. If there is a special tendency to complications of some sort, the mortality is increased.

Alterations.—At the time of death from contagious pneumonia, septic changes and the evidences of putrefaction are frequently found. The solidification of the lung tissue is irregular in shape and high around the root of the lungs and the large bronchi and is generally covered by sound lung tissue. The anterior lobes of the lungs are usually entirely affected. The diseased portion is of a gray-yellowish color, somewhat watery, and tears readily. Pus is found in the air tubes, which form channels through the jellylike mass of the diseased lung. Abscesses from the size of a nut to larger masses may be found throughout the lungs. The blood is dark in color, fluid, or clotted into soft, jellylike masses. Masses of gangrenous or black dead tissue may be present.

Prevention and treatment.—Those horses in the stable that have an elevated temperature, as well as those with symptoms of lung involvement, should immediately be isolated and the stable thoroughly cleaned and disinfected. It has been observed that the mortality from the disease is greatest in those animals in which the disease has not been discovered early, the animals having been worked when in a feverish condition. Approximately half of such animals die in spite of the best treatment.

As in influenza, the early recognition of the disease, together with isolation and good nursing, is most beneficial. The medicinal treatment is much the same as that for influenza, varying according to the severity of each case. In some cases it is necessary to tap the chest cavity for the purpose of withdrawing accumulated fluids. It may be necessary to repeat this procedure. Some veterinarians use various of the sulfonamide drugs or arsenical preparations with reported good results. Anti-hemorrhagic-septicemia serum has been used in some cases with apparent advantage.

A long period of rest is necessary for recovering animals. Those put to work too soon often suffer a relapse that is fatal. Whenever possible, the stable should be vacated for a month after disinfection.

STRANGLES

Synonyms.—Distemper; colt-ill; catarrhal fever; one form of shipping fever.

Definition.—Strangles is an acute, infectious disease of the horse, mule, and ass, seen most frequently in young animals. It appears

as a fever lasting for a few days and is usually associated with an inflammation of the nasal mucous membrane and abscess formation of lymph nodes, especially those under the jaw, which have a tendency to break on the outside. It usually leaves the animal, after convalescence, perfectly healthy and as good as it was before but sometimes leaves it a roarer or is followed by the development of deep-seated abscesses that may prove fatal.

Cause.—The cause of strangles is infection by direct contact with an animal suffering from the disease, or indirectly through contact with the discharges from an infected animal. These discharges may be present in the mangers, feed troughs, water troughs, etc. It is believed also that stallions and mares in breeding stables may become infected at time of service. The causative agent of this disease is generally agreed to be the micro-organism known as *Streptococcus equi*, but it is possible that some other underlying virus may be present. This germ is frequently present in other acute infections of various organs such as the nose, throat, lungs, umbilicus, and joints of foals, and the udder, vagina, and womb of the mare. The organism, according to Richter, is very resistant when in the discharges of pus and blood. It has been found in the nasal chambers of old horses and from apparently normal horses. There are many predisposing causes that render some animals much more likely to contract the disease than others. Since young horses are especially susceptible to the disease, as they have never been exposed to it, the popular name "colt ill" has been applied. The animal ordinarily contracts the disease but once, and the large majority of adult and old animals have derived an immunity from previous attacks. At 2 to 5 years of age the colt, which has been kept from sources of contagion, is shipped to the show or to market and may there be exposed to other horses suffering from disease and serving as infecting agents. The opportunities for the contraction of infection are multiplied wherever many horses of all types and ages are gathered together. Varying numbers of these are infected at the time they are placed in the truck, car, or boat for shipment and are gathered in stockyards or sales stables. Young animals purchased from such sources often carry the infection to susceptible horses on the farm, at the show, or in training stables.

Thoroughbred colts are very susceptible and frequently contract strangles at a somewhat earlier age than those of poorer breeding. Mules and asses are believed by some to be much less susceptible than horses. Other animals are not subject to this disease as far as is known. After exposure to infection there is a period of incubation of the disease, lasting from 2 to 8 days, during which the animal's health is the same as usual.

Symptoms.—The horse at first is a little sluggish if used, or when placed in its stable is somewhat dejected, paying little or no attention to occurrences that would ordinarily arouse its interest. The appetite is somewhat diminished in many cases, whereas in some cases the animal eats well throughout. Thirst is increased, but not a great deal of water is taken at one time. If a bucket of water is placed in the manger the animal will dip its nose into it and swallow a few mouthfuls, allowing some of it to drip back and then stop, to return to it in a short time. The coat becomes dry and the hairs stand on end. At times the horse will tremble; sometimes in one leg, in the forequarters, the hindquarters, or in severe cases in the whole body.

If the eyes and mouth are examined the membranes are usually found to be reddened to a bright rosy color. The pulse is quickened and the breathing may be slightly accelerated. At the end of 2 days a cough is heard and a discharge begins to come from the nostrils. This discharge is at first watery; it then becomes thicker, somewhat bluish in color, and sticky, and finally it assumes a yellowish color and increases greatly in quantity.

At the outset the colt may sneeze and cough occasionally. The cough is at first harsh but soon becomes softer and moist as the discharge increases. Again, the cough varies according to the source of the discharge, for in light cases this may be only a catarrh of the nasal passages, or it may be from the throat, the windpipe, or the air tubes of the lungs, or even from the lungs themselves. According to the organ affected the symptoms and character of cough are those of a laryngitis, bronchitis, or lung fever.

Shortly after the discharge is seen, a swelling usually occurs under the jaw or in the intermaxillary space. This is at first puffy, somewhat hot and tender, and finally becomes distinctly so, and an abscess is felt, or, having broken itself, the discharge is seen dripping from a small opening. When the discharge from the nostrils has fully developed, the fever usually disappears and the animal regains its appetite, unless the swelling is sufficient to interfere with the function of the throat, causing pain on any attempt to swallow. At the end of 4 or 6 days the discharge lessens, the soreness around the throat diminishes, the horse regains its appetite, and in 2 weeks has often regained its usual condition. Old and strong horses may have the disease in so light a form that the fever is not noticeable; they may continue to eat and perform their ordinary work as usual, and no symptom may be seen beyond a slight discharge from the nose and a rare cough, which is not sufficient to worry any but the most particular owner. On the other hand, the disease may assume a malignant form and even prove fatal. Inflammation of the larynx and bronchi, if excessive, produces violent, harsh coughing, which may almost as-

phyxiate the animal. The large quantity of discharge may be mixed with air by the difficult breathing, and the nostrils, the front of the animal, manger, and surrounding objects become covered with a white foam. The inflammation may be in the lung itself (lobular pneumonia) and cause the animal to breathe heavily, heave at the flanks, and show great distress. In this condition marked symptoms of fever are seen, the appetite is lost, the coat is dry, the horse stands back in its stall at the end of the halter strap with its neck extended and its legs propped apart to favor breathing. This condition may end by resolution, leaving the horse for some time with a severe cough, or the animal may die from choking up of the lungs (asphyxia).

The swelling under the jaw may be excessive, and, if the abscess is not opened, it burrows toward the throat or to the side and causes inflammation of the parotid glands and breaks in annoying fistulas at the sides of the throat and even up as high as the ears. Roaring may occur either during a moderately severe attack from inflammation of the throat (larynx) or at a later period as the result of continued lung trouble. Abscesses may develop in other parts of the body, in the poll, in the withers, in the spaces of loose tissue between the forelegs, in the fold of the thigh, in the udder of the mare, or in the testicles.

During the course of the disease, or later, when the animal seems to be on the road to recovery, abscesses may form in the internal organs and produce symptoms characteristic of disease of those parts.

Plunging, wandering in a circle, or standing with the head wedged in a corner of the stall indicate infection of the brain. Sudden and severe lung symptoms, without previous discharge, point to an abscess between the lungs, in the mediastinum. Colic, which is often continuous for days, is the result of the formation of an abscess in some part of the abdominal cavity, usually in the mesentery but sometimes in the liver, spleen, or kidneys. Other complications are ulceration and hemorrhage in the nasal mucous membrane, accumulations of pus in the spinal canal, guttural pouch, joints, or tendon sheaths.

Pathology.—The lesions of strangles are found on the surface of the mucous membranes, essentially of the respiratory system, and in the loose connective tissue fibers of the internal organs and glands, and consist in acute inflammatory changes, tending to the formation of pus. The blood is unaltered, though it is rich in fibrin, and if the animal has died of asphyxia it is found to be dark colored and uncoagulated when the body is first opened. If the animal has died while suffering from high fever the ordinary alterations throughout the body, which are produced by any fever not attended by alteration of blood, are found.

Prevention.—Healthy horses should be separated from the infected animals, and the stables in which the disease has occurred should be thoroughly disinfected and preferably left vacant for 3 to 4 weeks.

Since the disease frequently occurs annually on infected premises, systematic disinfection should be practiced after an outbreak. The stables, as well as all utensils that might have come in contact with the infection, should be thoroughly disinfected. By such practices recurrences of the disease may be prevented.

There is some evidence that some of the bacterins, consisting of killed bacteria obtained from cases of the disease, may assist in preventing the disease, particularly if they are injected a sufficient time before exposure occurs. A less lasting, but apparently appreciable, resistance in some cases may be induced by the injection of serum from horses that have been rendered highly immune to the streptococcus and other germs by the inoculation with increasing quantities of these. Such serum conveys a so-called passive immunity that probably does not endure for more than 3 weeks at the most. The choice of the biological agent to be used, if any, and the dosage and method of administration are technical considerations that should be decided by a trained veterinarian.

Treatment.—Ordinary light cases require little treatment beyond diet, warm washes, moistened hay, warm coverings, and protection from drafts or cold. However, the frequency with which the several complications may occur necessitates that, for the sake of safety, every case should be attended by a veterinarian. This practice will usually result in the early discovery of developing cases and their isolation from other horses. The sooner the case receives attention, the better are the chances for uncomplicated recovery. Before abscesses develop, serum may be given advantageously. In some cases, bacterins are injected repeatedly.

When the disease breaks out, the provision of individual receptacles for feeding and watering will often impede its spread. Soiled litter and the discharges from infected animals are preferably burned. If abscesses develop, it is of advantage in some cases to lance them, thus establishing drainage and permitting the use of antiseptics in the cavities. In such instances, however, more harm may be done by lancing these too early than by allowing them to break, unless breathing or swallowing is interfered with.

Blisters and irritating liniments should not be applied to the throat. When lung complications occur the horse may have mustard applied to the belly and to the sides of the chest. Tracheotomy, incision of the trachea and insertion of a tube, may be necessary in some cases, to prevent suffocation. When convalescence begins great care must be taken not to expose the animal to cold, which may bring on relapses. Although moderate exercise is of great advantage, the animal should not be worked until it has entirely regained its strength. Blood transfusion may be given in some cases. There is no specific medicinal

remedy, though symptomatic medication is often advisable in conjunction with good nursing.

PURPURA HEMORRHAGICA

Synonyms.—Petechial fever; morbus maculosus; hemorrhagic toxemia.

Definition.—This is a noncontagious, acute or subacute, toxemic affection, usually secondary but sometimes apparently primary, which is characterized by small hemorrhages of the mucous membranes, skin, or internal organs, and the accumulation of watery fluids (edema) in the tissues beneath the skin.

Cause.—The true cause of purpura hemorrhagica is not entirely agreed upon. However, it has been noted that the disease occurs more commonly in animals with the history of having had strangles, influenza, contagious pneumonia, or some other severe debilitating disease or chronic septic process. A few cases without such history are encountered from time to time. Against the theory that the disease is a microbic infection is the fact that no particular organism yet isolated from these cases has been found to be capable of producing the disease in animals exposed to it nor have blood or discharges reproduced the disease. A common opinion is that the disease is an auto-intoxication or the absorption of bacterial toxins originating in a preceding primary focus of infection. Another theory as to the cause of the condition is that a preceding infection has sensitized the animal to the toxins formed by certain bacteria at that time. The particular sensitiveness to this toxin becomes evident as purpura hemorrhagica when a subsequent exposure to the same toxin takes place. Whatever the direct cause, there occur in purpura hemorrhagica a blood disturbance and a leakage of blood and serum from the blood vessels that, in most instances, appear to be associated with a previous, obvious infection. The malady is, therefore, included in this discussion of infectious diseases, even though it is doubted that the disease is essentially of an infectious nature.

Symptoms.—The disease usually develops rather suddenly, though the several changes seen in the disease may appear gradually. Usually hemorrhages from the size of a match head to that of a silver quarter develop early in the visible mucous membranes of the body, nostrils, nasal chambers, eyes, lips of the vulva, or the mouth. They may appear either suddenly or gradually and may or may not be accompanied with a discharge, sometimes bloody, from the part.

Soon after the hemorrhages develop, or at about the same time, there is noticed a swelling, or several swellings, occurring on the surface of the body—on the forearm, leg, undersurface of the belly, or side of the head. The tumefaction is at first the size of a hen's egg; not hot, little sensitive, and distinctly circumscribed by a marked line from the surrounding healthy tissue. The hair over these areas

usually stands erect in contrast with that over uninvolved parts. The swellings gradually extend until they coalesce, and in a few hours there may be swelling of the legs, legs and belly, or the head, to an enormous size. They always have the characteristic constricted border, which looks as if it had been tied with a cord. In the nostrils the reddish spots, petechiae, or echymoses, according to their size, gradually assume a brownish and frequently a black color. Examination of the mouth frequently reveals similar lesions on the surface of the tongue, along the lingual gutter, and on the frenum. If the external swelling has been on the head, the petechiae of the mucous membranes are likely to be more numerous and to coalesce into patches of larger size than when the dropsy is confined to the legs. The animal may be stiff from the swelling of the legs or be annoyed by an awkward swollen head, which at times may be so enormous as to resemble that of a hippopotamus rather than that of a horse. During this period the temperature remains practically normal; the pulse, if altered at all, is only a little weaker; the respiration is hurried only if the swelling of the head infringes on the caliber of the nostrils or other parts of the air passages. The appetite usually remains normal at first. The animal is attentive to all that is going on, and, except for the swelling, apparently is in good health.

In 2 to 4 days, in severe cases, the tissues can no longer resist the pressure of the exuded fluid. Over the surface of the skin that covers the dropsy a slight serous sweating occurs, which loosens the epidermis and dries so as to resemble the eruption of some cutaneous disease. If this is excessive, irritated spots that are suppurating and foul smelling sometimes appear. In the nasal fossae the hemorrhagic spots may greatly increase in size, and a blood-stained catarrhal and sometimes fetid discharge may develop. There may be some enlargement and peripheral edema of the lymphatic glands, which are fed from the affected part. The thermometer indicates a variable, usually slight, rise in the body temperature, and the pulse and respiration are somewhat accelerated. The appetite often remains good in spite of the severe symptoms. In the course of a few days the temperature may have reached 102° to 104° F.

Fever occurs, not an essential or specific fever, but as a secondary condition produced by the dead material from the surface or superficial suppuration and by the oxidization and absorption of the toxic material contained in the tissues. The skin may suppurate or slough more or less over the areas of greatest tension or where it is irritated by blows or pressure. The great swelling about the head may by closure of the nostrils interfere seriously with breathing. Internal edema may occur in the throat, lungs, or intestines. Septicemia, or blood poisoning, may result from an infection of the accumulated fluids in the various parts of the body.

Terminations.—The simple form of the disease most frequently terminates favorably on the eighth or tenth day by resolution or absorption of the effusion, with usually a profuse diuresis, and with or without diarrhea. The appetite remains good or is at times capricious.

Death may occur from mechanical asphyxia, produced by closure of the nostrils or the glottis. Metastasis to the lungs, resulting in pulmonary edema, is almost invariably fatal, causing death by asphyxia. Metastasis to the intestines may lead to death from enteritis, hemorrhage, or necrosis.

Excessive suppuration, lymphangitis, and gangrene are causes of a fatal termination by exhaustion. Death may result from continued inability to swallow in cases of excessive swelling of the head.

Peritonitis may arise secondary to the enteric edema or by perforation of the stomach or intestines by a gangrenous spot. Septicemia terminates fatally with its usual train of symptoms.

Alterations.—The essential alterations of purpura hemorrhagica are simple despite the gross lesions observed. The capillaries are dilated; the lymphatic spaces between the fibers of the connective tissue are filled with serum; and the coagulable portion of the blood presents a yellowish or citrine mass, jellylike in consistence, which has stretched out the tissue like the meshes of a sponge. When the effusion has occurred between the muscles, as in the head, these are found to be separated from each other like those of a hog's head by the masses of fat. The surface of the skin is desquamated and frequently denuded of hair. Frequently there are suppuration and ulceration. The mucous membrane of the nose is studded with small, hemorrhagic spots, sometimes red, more frequently brown or black, often coalesced with each other in irregular-sized patches and surrounded by a reddish zone, the result of irritation. If edema of the intestines has occurred, the membrane may be four or five times its normal thickness, reddish in color, with hemorrhages on the free surface. Edema of the lungs leaves these organs distended by the accumulated fluid. The secondary alterations vary according to the complications. Lesions of asphyxia are frequent. Externally there may be ulcers, abscesses, and gangrenous spots and the deep ulcers resulting from the latter. The lymphatic cords and glands have all the lesions of lymphangitis. Again there are traces of excessive emaciation or the lesions of septicemia.

Diagnosis.—An attempt by the untrained person to diagnose this disease may result in confusion with such serious diseases as glanders or anthrax. Some cases of the disease must be differentiated from lymphangitis, malignant edema, acute infectious anemia, strangles, and even influenza. The accurate diagnosis of the disease is essentially a task for the veterinarian.

Prognosis.—Although purpura hemorrhagica is not an excessively fatal disease, the prognosis must always be guarded. A certain percentage of the cases run a simple course and terminate favorably at the end of 8 to 10 days, or possibly, after one to two relapses, requiring several weeks for complete recovery. Effusion into the head renders the prognosis somewhat more grave from the possible danger of mechanical asphyxia. Threatened mechanical asphyxia is especially dangerous on account of the risk of blood poisoning after an operation of tracheotomy. Edema of the viscera is a serious complication. The prognosis is based on the complications, their extent, and their individual gravity, existing, as they do, in an already debilitated subject.

Treatment.—Since opinions vary as to the exact cause and nature of the disease, the treatment is of a symptomatic nature and largely experimental. A drug that would be beneficial in one case might be distinctly harmful in another.

Good hygiene and nursing are both believed to be of distinct advantage in this disease. Such feeds as are allowed should be of a light, laxative nature. These may be in the form of moist bran and linseed mashes, oatmeal gruel, or barley water. Aside from this care, such treatment as is given should be applied by or under the direction of a veterinarian. According to the nature of each case this may be stimulant, nourishing, antiseptic, or supportive in character. Thus the injection of adrenalin, an extract from the adrenal gland, is used with apparent benefit in some cases. Various dyes and antiseptic preparations are sometimes injected into the veins. Again, a blood transfusion from a healthy horse may be given. If asphyxia threatens, it may be necessary to admit air through a tube placed in the trachea. In other cases tapping of the thoracic or abdominal cavities for the purpose of withdrawing excess fluid may be beneficial.

The halter should be removed if the head swells and pressure bandages should not be placed on the legs. It is generally conceded that drenching is to be avoided as far as possible in this disease and that drastic purgatives may have a distinctly harmful effect. To scarify or puncture the swollen tissues only exposes them to infection and necrosis and may thus cause the development of a fatal toxemia or septicemia. In some cases, alternating hot or cold packs, either with or without medicaments, may be advised for the swollen parts.

A long period of rest is necessary for animals recovering from the disease. During the convalescent period, pasturing during mild weather, together with certain tonics, may be prescribed by the veterinarian.

INFECTIOUS ANEMIA (SWAMP FEVER)

Infectious anemia of horses, known also as swamp fever, American surra, malarial fever, slow fever, mountain fever, typhoid fever of

horses, the unknown disease, no-name disease, plains paralysis, and pernicious anemia, is an acute or chronic disease of equines (horse, mule, and donkey) caused by filtrable ultramicroscopic virus. It is characterized principally by an intermittent fever, marked depression, progressive weakness, edema, loss of weight, congestion, icterus and petechial hemorrhages of the conjunctival mucosa, and frequently anemia of a transitory or progressive type.

Prevalence and distribution.—The disease occurs principally in animals on pasture and is most prevalent in low-lying and badly drained sections of the country, although it has been found in wooded sections and in altitudes as high as 7,500 feet on marshy pastures during wet seasons. It is also more prevalent during wet years than in dry seasons and when flying, biting insects are most numerous. The severity of the disease appears to vary with the season. It usually makes its appearance in the acute form during the hot months of summer, beginning in May or June, reaching its height in midsummer, and increasing in frequency up to late autumn, when it again declines. Chronic cases may be seen at all seasons of the year, and it is possible to produce the disease experimentally at any time.

Long recognized as a specific infectious disease of equines, infectious anemia was reported from Europe as early as 1843. The disease has a wide geographical distribution, occurring in various parts of Europe, Asia, Africa, and North America. An outbreak of the disease has been reported from Venezuela, South America. The disease has existed in the United States for at least 50 years and since 1900 has been reported from at least 29 States, namely, Arkansas, California, Colorado, Florida, Idaho, Illinois, Indiana, Kansas, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Montana, Nebraska, New York, Nevada, North Dakota, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, and Wyoming.

With the exception of the Mississippi Delta, the disease occurs in the United States mostly as a sporadic infection, isolated cases or outbreaks for the most part being reported from and confined to low-lying and wooded sections in the States where the disease exists. In the Mississippi Delta the disease has become established among the mules on the large cotton plantations and is of considerable economic importance. In this area the disease exists principally in the chronic form, saps the strength of the animals, and renders them incapable of regular work in the busy cotton-growing season when they are most needed.

Cause.—It has been proved conclusively that infectious equine anemia is produced by a filtrable virus, which is capable of passing through the pores of the finest porcelain filters, like the viruses causing foot-and-mouth disease, rinderpest, hog cholera, and similar

diseases. The virus, which is apparently constantly present in the blood of affected animals, may be transmitted to equines by either subcutaneous or intravenous inoculation of the whole blood, the defibrinated blood, or the blood serum that has been passed through a fine Pasteur filter, thus eliminating all the visible forms of organismal life, including bacteria, trypanosomes, and piroplasmata. This virus has also been found to be active in the carcass of an affected animal 24 hours after death. It may also be present in urine, feces, milk, and nasal and eye secretions.

The virus shows considerable resistance against disinfectants and other external influences. It resists freezing and drying for long periods of time but is killed by heating for 1 hour at 60° C. or exposure to full sunlight for 2 hours. It may maintain its virulence for several weeks when contained in the soil, feces, or urine. Ether, chloroform, sodium fluoride, and weak solutions of carbolic acid and cresol have little or no action on the virus. Lye and formalin in strong solution appear to be the most effective disinfectants against this virus.

Following the injection of the infectious principle there is a period of incubation that may extend from 6 days to 1½ months, or even longer at the end of which time the onset of the disease is manifested by a rise of temperature.

The infection may take an acute or subacute course or, if uncomplicated, frequently runs a chronic course terminating in death, usually with an acute flare-up in from 3 months to 1½ years, or even longer. Some animals may appear to recover but continue to be carriers of the virus for a number of years although manifesting no clinical symptoms of the disease.

Transmission.—Although dissemination of the disease usually follows the introduction of infected horses into noninfected territory, the common method of transmission in nature is not known with certainty. Ordinarily the disease appears to spread slowly. Conditions that lower the resistance appear to create a favorable environment for the development of infection. A number of investigators who have worked on this problem are of the opinion that the disease is spread principally in pastures as a result of ingestion of infected fodder, litter, and drinking water, or by means of biting, flying insects, principally the blood-sucking flies, such as the horsefly or stablefly, which transmit the disease in a purely mechanical manner. The possibility of these modes of transmission is sustained by experimental evidence. The fact that the blood and urine are considered to be the greatest source of infection and that most animals appear to acquire the disease while on pasture also lends support to these theories of natural dissemination.

Susceptibility.—Under natural conditions members of the equine family appear to be the only animals susceptible to the disease. Mules

seem to be somewhat more resistant to the infection than horses. The infection has been reported in man in a few instances by investigators in Europe, but it is probable that man is not very susceptible to the disease. In experiments conducted by the Bureau, equines only were found to be susceptible. Attempts to infect calves, sheep, swine, dogs, rabbits, rats, mice, pigeons, and guinea pigs were unsuccessful. Some investigators in foreign countries, however, have reported that a few other species, including swine, young goats, guinea pigs, rabbits and poultry, can be infected under experimental conditions. In localities where infectious anemia has existed for a number of years, the mild type of chronic cases is most common. In fact, there is considerable evidence to indicate that when the infection first appears in new territory the more susceptible animals die of the acute type of the infection but after the disease has been present for a number of years the animals appear to become tolerant to the virus.

Forms of the disease, symptoms, and termination.—The clinical symptoms are variable and depend to a great extent on the form the disease assumes. Infectious anemia may occur as an acute, rapidly fatal disease or more commonly as a chronic affection characterized by intermittent attacks of fever, loss of weight, progressive weakness, marked depression, and dropsical swellings on the lower portions of the body and on the legs. The disease may also exist in a form in which no clinical symptoms are observed, yet the affected animal carries virulent virus in the blood stream at all times.

In naturally occurring field cases the disease begins to manifest itself by a dull, listless appearance and by general weakness, the animal tiring easily. This stage is followed closely by a staggering, swaying, uncertain gait, the hind legs being mostly affected. There are also weakness and tenderness in the region of the loins. The heart is usually very weak, as indicated by a weak, soft pulse that may run as high as 70 and become irregular following violent exercise.

The temperature may rise to 103° F. or much higher and remain elevated for 3 to 5 days or longer and then drop to rise again irregularly. The affected animal may appear to improve for a time, but usually this improvement is followed by a more severe attack than the first. Often a fluctuating pendulous swelling may appear on the lower lip, point of elbow, sheath, legs, sternum, under the belly, or on some other pendent portion, especially late in the course of the disease.

In the acute form of the disease, the incubation period following the subcutaneous injection of infected blood is usually about 12 to 15 days. However, it may vary from less than a week to 3 months and possibly longer. The onset is sudden and is manifested by a rise in temperature that usually reaches about 105° F. but may reach 108°. The irregular recurrent fever is one of the chief clinical manifestations of the disease, and in mild cases it sometimes consti-

tutes the only symptom. Respiration is accelerated and frequently is of the abdominal type. The animal is dejected, the head hangs low, leg weakness is marked, the body weight is shifted from one leg to another, and the hind feet are frequently placed well forward under the body. The membranes of the eye show congestion, followed by brownish to yellowish discoloration. Feed is refused. There may be a slight watery discharge from the eyes and nose and, if the weather is extremely warm, profuse sweating. Frequent urination may also be noted, and in severe cases diarrhea may develop. The attack usually lasts from 3 to 5 days, after which the temperature returns to normal, and the animal appears to be well, except for a marked loss of weight.

Occasionally, however, the initial attack may persist until the animal dies. Dropsical swellings of the sheath, legs, breast, and under surfaces of the body may occur at any time. These frequently disappear and appear again at the same or other places. Subsequent attacks usually follow, with intervening periods of normalcy varying from a few days to many weeks or months. When the intervals between the attacks of fever are short the animal seldom lives more than 15 to 30 days. During the attacks of fever and immediately afterward, there is a destruction of red blood corpuscles, usually 1 to 1½ million per cubic millimeter. The red-corpuscle count in exceptional cases has been noted to fall to 3 or 4 million per cubic millimeter. When the reduction of red corpuscles is pronounced, it can be readily demonstrated by drawing blood into a test tube in the bottom of which a small quantity of powdered potassium oxalate or other anticoagulant has been placed to prevent clotting. A little agitation of the test tube during the drawing of the blood and immediately afterward in the presence of the anti-coagulant will prevent clotting and permit the red corpuscles to gravitate to the bottom of the tube. A comparison of the sedimented red corpuscles with a sample similarly drawn from a normal horse will clearly demonstrate the degree of anemia that exists. In addition the supernatant serum will occasionally exhibit a marked yellowish hue. During the periods of normalcy, between the attacks, the red-corpuscle count in most cases returns to the preattack level. However, in some instances, a moderate degree of anemia may persist.

The subacute and chronic forms of the disease differ from the acute in that the attacks are less severe and the intervals between them are longer. The subacute cases may terminate in death during or following one of the attacks or the reactions may grow less frequent, the animal finally developing into a chronic case or a clinically recovered carrier. In general, the chronic form is manifested by unthriftiness, rough coat, underweight, sluggishness, weakness, dropsical swellings of the lower parts of the body or on the legs, muddy

discoloration of the visible mucous membranes, and small hemorrhages on the nictitans membrane (the third eyelid, or haw) and the nasal septum (the partition between the passages of the nose).

As the disease progresses, evidence of anemia may develop, the red-corpuscle count may be extremely low, the blood may appear thin and watery, and in the later stages the visible mucous membranes may become pallid. The pulse may be slow and weak, the heart action may become irregular, and a jugular pulse may be visible. Following exercise, there may be a rapid slowing of the pulse. Muscular weakness is manifested by a wobbly or rolling staggering gait or by partial paralysis of the hind quarters. In the chronic form of the disease the appetite is unimpaired for the most part and frequently is ravenous, so that the animals may eat continuously if they have access to feed. In spite of the excessive consumption of feed, however, there is a progressive loss of body weight.

Animals affected with this form of the disease can perform some work if handled with care. They are subject, however, to recurring attacks characterized by extreme weakness, knuckling, inability to walk in a straight line, and prominent hemorrhages on the nictitans membrane. The weakness may become so great that the animal cannot stand without support. With good attention, rest, and supportive treatment, the animals usually overcome these periodic attacks and may go back to their routine work. Each attack takes its toll of flesh and strength, however, and repetitions, if frequent enough, will so weaken the animals as to render them useless or finally bring about death by exhaustion. The North Dakota Agricultural Experiment Station reported a horse affected with the chronic form of infectious anemia that lived for 14 years and, as 18 horse-inoculation tests showed, was infectious during the entire period.

The inactive or latent form of the disease may follow the first attack, but usually it is preceded by several attacks of fever. In this form of the disease no clinical symptoms can be observed in the affected animal. The temperature remains normal, no reduction in the red corpuscles takes place, and a complete absence of any sign of disease will extend over a period of years. Yet all the while the infectious agent is present in the blood stream and all the tissues and may be eliminated with the body excretions. Such animals obviously are dangerous and are a menace to other horses near them since they are veritable reservoirs of infection that for the most part go unrecognized and uncontrolled. The inactive form of the disease may, however, become active at any time, and present all the characteristics of the acute or subacute form of the disease. Unusually hard work or any debilitating influences may reactivate the inactive form.

The Bureau of Animal Industry has had under experiment a horse that is a good example of the inactive form of infectious anemia.

This horse was exposed to the disease August 2, 1935, by being given an injection of filtered blood from two horses known to have infectious anemia. After an incubation period of 12 days, a typical attack of fever occurred, which in turn was followed by two more attacks within a 3-week period. No further attacks occurred over a period of approximately 5 years. During this time this animal remained in good physical condition and showed no symptoms of disease whatsoever, yet blood drawn from it at intervals during the 5 years produced infectious anemia when injected into normal horses. A horse with a similar history that has been infected for approximately 6 years is also being held under observation, and although this animal has shown no clinical symptoms for more than 6 years its blood remains infectious.

The Wyoming Agricultural Experiment Station reported a case of infectious anemia produced experimentally in an 18-year-old horse. This animal, although continuously infected with the disease, as proved by horse inoculation tests, lived to be 33 years old.

Anatomical changes.—The changes in the body tissues resulting from infectious anemia are variable. They may be extremely well marked and plainly visible or so slight as to escape detection by those who have not had considerable experience with the disease. For the most part the changes in the acute cases are more extensive and pronounced than those in the chronic cases. The most constant gross changes are hemorrhages on the serous and mucous membranes of the body, with enlargement and other changes of the spleen, kidneys, liver, and heart. The hemorrhages are most frequently found on the pericardial sac, the pleura (covering the lungs and the surface of the ribs), the peritoneum, the mucous membrane of the small and large intestines and cecum and the surfaces of the spleen and kidneys. The spleen is frequently enlarged and soft. Occasionally it will be found to be approximately three times its normal size, and the splenic pulp will be soft and dark red. The liver is often enlarged to enormous proportions and is hard and friable. The surface sometimes presents a mottled appearance as a result of areas of degeneration that are lighter in color. Occasionally hemorrhages are seen beneath the capsule of the liver. On cross section, the lobules of the liver stand out prominently and present a nutmeg-like appearance. The kidneys are frequently enlarged, watery, and lighter in color than normal and may have numerous hemorrhages on the surface, ranging in size from that of a pin point to several millimeters in diameter. The heart is usually enlarged, flabby, lighter in color than normal, and may have hemorrhages on the surface, in the muscle wall, and on the inner surface of the heart muscle forming the heart cavities. The heart fat frequently loses its normal consistence and color and becomes soft and gelatinous. The visceral lymph glands may be enlarged, watery, and impregnated with hemorrhages. Large hem-

orrhagic areas are frequently seen in the marrow of the long bones, especially the femur. The marrow is softer than normal and in some instances becomes gelatinous. A yellowish discoloration of connective tissues and fat may also be evident. In some cases the anatomical changes are so pronounced as to make a striking picture, but, as previously stated, the lesions are variable and may occur in any combination.

In chronic cases that die from exhaustion following a protracted illness, lesions indicative of cachexia are usually observed, such as emaciation, gelatinous infiltration of connective tissue and fat tissue, especially the fat tissue of the heart, and a blanched appearance of mucous membranes. In such cases the hemorrhagic infiltration of tissues and degenerative changes of the organs may be slight or entirely absent. In those subacute or chronic cases showing clinical manifestations of a progressive anemia, the autopsy may also show pale mucous membranes and light-colored, thin, watery blood. In latent cases (symptomless carriers) and chronic cases of a mild type, little or no anatomical alterations are observed on autopsy. The most constant and characteristic histopathological findings in infectious anemia are round-cell infiltration and a heavy deposition of hemosiderin in the liver and spleen. When animals are autopsied, the post mortem and histological findings are of considerable assistance in making a tentative diagnosis.

Prognosis.—The prognosis of the disease is very unfavorable. Veterinarians in those sections of the country where it is prevalent report a mortality of 60 to 75 percent; this applies especially to the acute type of the disease. In territories where the disease appears to be well established, as in the Mississippi Delta, the chronic type predominates and losses from infectious equine anemia result principally from inability of affected animals to perform a normal amount of work. Losses from death are usually of lesser significance.

Diagnosis.—Diagnosis of infectious anemia is for the most part difficult since there are no symptoms or post mortem changes that can be considered characteristic and peculiar to this disease alone. The only definite means of diagnosis is by horse-inoculation test. Considering collectively the history, clinical symptoms, and blood examinations, diagnosis with a reasonable degree of accuracy can possibly be made in the active form of the disease. For example, a history of rapid loss of flesh, loss of spirit and energy, evidences of muscular weakness with intermittent attacks of fever, congestion of the mucous membranes of the eye, with possibly some degree of jaundice, and dropsical swellings of the lower parts of the body, collectively, are strongly suggestive of infectious anemia. The tentative diagnosis will be further strengthened if during and immediately after the febrile period an examination of the blood shows a diminution in the

volume of the red corpuscles, an increased rate at which they gravitate, and a decrease of hemoglobin. It must be remembered, however, that in the intervals between the attacks of fever the blood picture in most cases promptly returns to normal. In practically all the Bureau's experimental cases, the diminution in the red corpuscles, that is, the anemia, was but transitory, and the corpuscle count returned to normal in the intervals between the attacks of fever. A few cases were observed, however, in which the anemia was of the progressive type. In one instance the corpuscle count rapidly and progressively diminished until the low level of $1\frac{1}{2}$ million red corpuscles per cubic millimeter was reached.

Infectious anemia in the inactive form would ordinarily not be detected since no clinical symptoms would be present to cause suspicion. It should be remembered also that heavy infestation with intestinal parasites, especially strongyles, produce symptoms that are in some respects similar to those of infectious anemia. Microscopic examinations of the feces for the eggs of these parasites and examination of blood films for evidence of eosinophilia will assist in making a differential diagnosis. It is possible, and in some areas probable, that some horses and mules will have heavy infestation with intestinal parasites and at the same time will be affected with infectious anemia in the chronic form. For further information on strongyle and other intestinal parasites of horses, the reader is referred to Circular 148, *Parasites and Parasitic Diseases of Horses*.

In acute cases occurring in the field, death may occur before the usual train of symptoms develops. The disease in the acute form may be confused with anthrax, influenza, purpura hemorrhagica, equine encephalomyelitis, and other acute febrile conditions. In the subacute and chronic forms it may be mistaken for trypanosomiasis (dourine, murrina, and surra) or strongyloidosis. No laboratory test has yet been found that is specific and at the same time dependable for detecting all affected animals.

Since the development of practical and reliable means of diagnosis is of primary importance from the standpoint of control, a considerable amount of experimental work on diagnostic procedures was carried out by the Bureau. None of the laboratory blood tests were sufficiently satisfactory to warrant adoption as a standard diagnostic method.

Treatment and control measures.—The control of this disease, because of its obscure nature, the difficulty of diagnosis, its resistance to treatment, and its widespread distribution, presents a problem of serious concern to all owners of horses and mules, especially those with large numbers of the animals.

Preventive vaccination has been attempted by a number of investigators, including those in the Bureau of Animal Industry. In the

investigations conducted by this Bureau none of the tissue vaccines prepared from whole blood, blood serum, emulsions of spleen tissue, or emulsions of brain tissue in which the virus was destroyed by formalin, crystal violet, phenol, phenyl mercury acetate, or heat had any appreciable immunizing value.

In searching for an effective treatment many investigators have tried numerous agents, such as arsenic preparations, quinine, various dyes, mercurial preparations, and a number of others, but without success. The Bureau experimented with merthiolate, crystal violet, trypan blue, sodium cacodylate, hydrochloric acid, potassium permanganate, fuadin, sulfanilamide, and other preparations, using both acute and chronic cases for these tests. None of the preparations, however, had any appreciable influence on the course of the acute disease, nor did any free the chronically infected animals of the virus. Since no specific medication has yet been found for the disease, treatment of affected animals is limited to symptomatic medication.

In sections where the disease is enzootic, or constantly present, practicing veterinarians employ supportive treatment, using arsenical compounds, principally sodium cacodylate, together with tonics, rest, and abundance of good feed, while eliminating intestinal parasites and other debilitating factors. Although such treatment brings about some clinical improvement, it has no lasting value, for the animal remains infected, is subject to febrile attacks, and is a virus carrier. To establish a complete cure, a method of treatment must be found that will not only free the animal of clinical symptoms but completely eliminate the virus from the tissues.

The control of infectious anemia depends primarily on the identification of the chronic carriers. Although no systematic program can be undertaken until a definite and practical means of diagnosis of chronic carriers is developed, the results of studies by the Bureau and other investigators indicate that the following measures constitute the most effective means of control.

When a definite diagnosis of infectious anemia has been made, it is advisable, if practicable, to kill the animal and dispose of the carcass by cremation or deep burial to prevent further spread of the infection. This method of control has been followed in small isolated outbreaks and in establishments keeping large numbers of horses, and it has been effective in preventing the spread of the disease. It is obvious, however, that the method is impracticable in such areas as the Mississippi Delta, where the disease is widely distributed and exists principally in a mild chronic form.

Known infected animals or suspected cases should be isolated from healthy animals. The safest procedure is to use separate water-

ing pails and feeding boxes for infected animals, and, where possible, to stable them separately.

The common use of equipment that may produce skin abrasions or absorb body excretions or secretions, such as bridles, harness, saddles, blankets, brushes, and currycombs, on both infected and healthy horses, is dangerous and should be avoided.

Since minute quantities of virus are infectious for susceptible animals and since carriers may show no symptoms of the disease, the greatest care should always be used to prevent transmission of the disease from animal to animal by the use of unsterilized instruments, bleeding needles, or hypodermic needles.

Since infected mares may transmit the disease to their offspring, such animals should not be used for breeding purposes.

Infected and healthy animals should not be kept in small, poorly drained paddocks adjacent to stables and manure dumps, as such places are likely to be contaminated with virus.

In badly infected premises or pastures where a number of cases of the disease have developed, it is advisable to move animals to new quarters, deeply plow the ground, and fence off the infected areas. Horses or mules should not be permitted on such pastures for at least 6 months.

The maintenance of good sanitary conditions, systematic control of intestinal parasites, and provision for a supply of pure, fresh drinking water should also receive attention, and under no circumstances should animals be permitted to drink from stagnant pools.

Since experimental evidence indicates conclusively that the disease may be transmitted from infected to healthy horses by both the horsefly and stablefly and since the appearance of new cases is closely correlated with the fly season, measures for the control of flying, biting insects should be applied when practicable.

INFECTIOUS ENCEPHALOMYELITIS

(See Diseases of the Nervous System, p. 196.)

RABIES (HYDROPHOBIA, OR MADNESS)

(See Diseases of the Nervous System, p. 196.)

TETANUS (LOCKJAW)

(See Diseases of the Nervous System, p. 196.)

INFECTIOUS ABORTION IN MARES

Infectious abortion (also known as contagious abortion, epizootic abortion, enzootic abortion) is a disease of mares that from a specific cause results in the premature expulsion of the fetus and its membranes from the uterus. It is characterized by an inflammatory condition of the female reproductive organs. Before the contagious nature of the disease was recognized, the disease was principally attributed to

various conditions, such as traumatic influences, various infectious diseases, spoiled feed, drugs, and other factors.

The earliest appearance of the disease in this country probably was in 1886, at which time it caused considerable damage to the horse-breeding industry in the Mississippi Valley. Smith and Kilborne investigated an outbreak in Pennsylvania in 1893, at which time they incriminated a germ belonging to the *Salmonella*, or paratyphoid group, as the causative factor of the disease. These findings have been subsequently substantiated by many investigators abroad, as well as in this country, notably De Jong, Dassonville, and Rivière, and by Good and Meyer. More recently valuable information was contributed to knowledge on this disease by Schofield, of Canada, especially with regard to the biological tests for diagnosis. The specific organism is at present referred to as *Salmonella abortusovae*.

This causative agent of infectious abortion in mares is not identical with the germ causing abortion in cattle. It exerts its action, however, in a similar manner, and appears to have, under certain conditions, a predilection for the genital organs of the mare, where it induces certain morbid changes whereby a premature expulsion of the fetus is the result. The germ is usually present in the fetal membranes and also in the aborted fetus. Mares may harbor the infection without disclosing any apparent ill effects.

The infected animals may carry the fetus through the normal period of pregnancy, giving birth to either a normal or a weak colt, or abortion may take place at any time during pregnancy, mostly, however, from the sixth to the ninth month.

In recent years Dimock and Edwards have demonstrated a *Streptococcus* that apparently causes some outbreaks of abortion in studs known to be free from infection with the *Salmonella* organism. In addition, these and other workers present evidence that a filtrable virus is responsible for abortion in some cases. Some abortion in mares has been found to be due to *Brucella* organisms, which cause specific abortion disease in cattle and swine, but such cases are rare. As far as is known, abortion due to these infections is not related to the disease here discussed.

Symptoms.—Symptoms suggestive of abortion are frequently entirely absent. At times the first symptoms of abortion may be colicky pains, restlessness, and periodical straining; these, however, are by no means constant, especially if abortion takes place in the early months of pregnancy. The genital organs may be swollen, showing a mucous discharge. Immediately before abortion the symptoms are more aggravated. Following abortion the discharge is more characteristic, being of a dark-brown color, sometimes even bloody, and contains streaky or flaky pus. The fetal membranes are not expelled in all cases with the aborted fetus, and there is a tendency to

retention of these membranes, which frequently has serious consequences on the health of the animal. It may become necessary to resort to manual removal of the afterbirth, and the inflammation of the uterus and a chronic discharge usually continues for some time. The expelled fetus as a rule, dies soon after the abortion, or if the expulsion has taken place at a time close to its full term the fetus is usually poorly developed and subject to various digestive and septic disorders. The fetus does not always have any particular abnormal appearance on external examination; in many cases, however, the post mortem examination reveals inflammatory changes of various organs.

The method of infection has not yet been satisfactorily determined; nevertheless it is believed that the principal modes of infection are probably the same as those for contagious abortion in cattle. These are especially by ingestion, that is, by taking up the germs with the feed, water, or other materials consumed, and possibly by way of the conjunctival membranes of the eye or even by the skin.

Infection through the genital organs is probably not so frequent, but in this regard the stallion may play an important role in spreading the disease. Schofield considers this method of infection as the principal source of the disease.

In infected stables the germs may be present throughout the premises. By keeping animals that have aborted in such stables, a contamination of feed and utensils may continually take place, since the aborted mares usually discharge a considerable quantity of material that is often heavily charged with the germs. The germ, if taken up by the body with the feed or water, presumably passes from the intestines into the blood, and from there is carried to the genital organs, where it finds suitable conditions for its development. Milk from an infected mare may also contain the germ, and colts may become infected by sucking the milk of infected mothers. In such instances the infection may remain dormant until the colt develops and becomes pregnant, when the organism, finding a condition suitable for its development, produces the disease.

On the other hand, stallions used in covering infected mares may become carriers of the germs, and when used for the breeding of healthy animals may transmit the disease to them.

Diagnosis.—Infectious abortion may be diagnosed by the changes that occur in the fetal membranes and, in some cases, also in the expelled fetus. In order, however, to substantiate a diagnosis with certainty, demonstration of the germ by laboratory methods is necessary. The occurrence of frequent abortions among the mares in a stable is also an additional evidence of the contagious character of the malady. At times infected mares may carry the fetus to full

maturity, in which case the diagnosis is possible only by blood examinations in a laboratory.

Infected animals usually abort only once; however, in some instances they may abort two to four times in succession.

Animals that establish a tolerance for the infection and carry the fetus to full maturity may nevertheless remain a source of danger for spreading the disease.

The tests used in laboratories for the diagnosis are the agglutination and complement-fixation tests, by which the disease may be diagnosed from a sample of serum from the blood of a suspected animal. Such tests, however, must necessarily be confined to laboratories that are equipped for such work.

Treatment and prevention.—Medicinal treatment is usually of no avail, except that which may be, in some cases, necessary for the removal of retained fetal membranes and improvement of the inflamed womb, after abortion has occurred. All efforts should be directed toward the prevention of the disease. Various medicinal agents have been recommended and exploited for treatment, but up to the present time no satisfactory evidence has been established as to their merits. As an aid in preventing the infection, bacterial vaccines prepared from the specific organism have been widely used, generally with apparently good results. Some work has been carried out which indicates that vaccines prepared from the *Streptococcus* sometimes found in aborting mares may be used in assisting to prevent abortion due to that organism. Abortion attributable to the filtrable virus may be prevented by vaccines made from aborted fetal tissues. It is, of course, of first importance that the exact nature of the infection in each stable be determined before any vaccine or other biological product is used.

Infected stalls and premises should be thoroughly cleaned and disinfected. (For methods, see section on Disinfection.) Large stalls to be used only for foaling should be a part of the equipment of every large stud, and at least one such stall is a distinct convenience and safeguard on the small breeding establishment or the general farm. Such an arrangement is of particular advantage on farms where infectious abortion is known to exist and where periodic blood tests permit the segregation of infected from noninfected animals. The aborting mares or those shown by the blood test to be infected, even though going full time before delivery of the fetus, should be placed, if possible, in a separate foaling stall to be used only by the potentially or known infected animals. Mares that are found not to show evidence of infection by means of the agglutination or complement-fixation tests and without other signs of disease should be placed in separate maternity stalls, well isolated from those used for aborting

mares or those reacting to the tests. After each abortion, the stall should be immediately cleaned and disinfected. The dead fetus and the membranes, as well as the litter from the stall, should be immediately burned so that any germs that may be present in the material will not be spread about the premises to cause the infection of other animals. The mare's tail, legs, and external genitals should be washed off with an antiseptic, such as 1-percent compound cresol solution. The aborting mare should be kept separate from other animals for 30 days after the discharge from the genital organs ceases. It is preferable that she not be bred for 90 days after the abortion and not then if a discharge persists or other evidence of infection of any part of the genital organs is detected.

The effective control of this disease, as well as other infectious diseases of animals, is essentially a task for the veterinarian. The examination and treatment of genital infections in general should not be entrusted to unqualified persons. Breeders sometimes use various antiseptic solutions purported to cleanse and heal the genital organs of both mare and stallion. Not all such treatments are safe or wise, and some may be actually harmful. The injection of solutions of any sort into the womb may be a dangerous practice except in experienced hands. Even then it is not always necessary to employ such methods to effect a return to normal.

NAVEL ILL OF COLTS

Navel ill of colts is also known as joint ill, omphalophlebitis, septic arthritis of sucklings, and pyosepticemia of the newborn. Among the germs most commonly found in the swollen joints, the inflamed umbilicus and tendon sheaths is that known as *Shigella equirulis*, which is sometimes, though rarely, also found in the womb of aborting mares. Various streptococci, especially those found in some aborting mares, *Salmonella abortivoequina*, *Corynebacterium equi*, and even colon bacilli, are responsible in other cases.

There are two main views as to the method by which foals contract these infections. One group of authorities holds that practically all infections take place through the umbilical cord at the time of birth. Others maintain that the infection becomes established in the fetus before birth. There are convincing arguments to favor both opinions, but it seems that under certain conditions either method or both may be held responsible. Suffice it to say that the disease is most common in unclean stables or those in which breeding troubles, including abortion and sterility, prevail.

Symptoms.—These are variable and appear to depend chiefly on the particular type of germ present in each case.

In *Shigella equirulis* infections the foal, if not dead when delivered, is usually weak and dull at birth. Some of these are the so-called

sleepers, many of which will not even nurse. In any case, the disease due to this organism usually becomes evident within the first 2 or 3 days of life. The stifle and hock joints particularly, and others less often, become much enlarged and sore. There is an elevated temperature and increasing stupor, following which most of the affected animals die in less than a week. After death, the fluid in the affected joints and tendon sheaths usually is found to be of a thick, yellowish gray, purulent nature. The kidneys and other organs frequently are greatly changed; often abscesses are found.

In streptococcic infection, the disease more commonly appears after the colt reaches an age of 1 to 2 weeks. The first symptom is usually a swelling of the joints, particularly the stifle and hock. With this type of infection, swelling and soreness of the umbilical region are common, and abscesses may develop there or within the body in the liver or other organs. There are gradually increasing weakness and loss of flesh, the foal finally dying of exhaustion, or in some cases recovery occurs after an illness of 2 to 3 weeks.

The colon organisms that are common inhabitants in the intestines of normal animals are the only ones to be found in some cases of navel ill. In these cases, the organisms commonly circulate in the blood stream, causing a septicemia and abscesses in various parts of the body, particularly the navel, the joints, or parts of the digestive system. The symptoms are usually evident at birth or soon after, death often occurring in from 1 to 4 days.

The pyosepticemia attributed to *Corynebacterium equi* commonly results in death from pneumonia.

Prevention and treatment.—There is a high percentage of deaths from these infections, particularly when they are not promptly treated; more may be accomplished by prevention. The treatment and prognosis depend largely on the type of infection present in a given case. In addition to general nursing and stimulants, some of the dam's blood is sometimes transfused directly into the foal. This may be done as a preventive measure and seems to have some curative value as well. In cases in which the type of infection has been determined, bacterins are sometimes prepared for use in prevention and treatment of the disease. Again, blood serum from horses highly immunized against the particular organisms involved is sometimes used. In some instances it may even be advisable to inject the pregnant mare with certain biological products at various intervals. All such procedures are to be undertaken only by a veterinarian. The owner can accomplish much in the way of prevention by cooperation with the veterinarian.

Among the most effective means of preventing diseases of the newborn foal are the modern methods of examining and treating both mare and stallion before breeding is attempted. Having mares free of genital

infections, and healthy, vigorous stallions to begin with, and clean quarters for foaling and care of the mare and her offspring, the greatest hazards to successful breeding operations are eliminated.

A separate, cleaned, and disinfected foaling stall should be provided for every mare approaching parturition. Before labor begins, the tail and the hindquarters of the animal may be washed in 1- or 2-percent compound cresol solution or other suitable antiseptic. At birth, the ruptured umbilical cord of the foal should be immersed for a few minutes in an antiseptic, preferably tincture of iodine. After the foal has nursed and the membranes have come from the mare, her hindquarters may again be washed preparatory to placing her and the foal in more suitable quarters.

GLANDERS (FARCY.)

(Pls. XL-XLII)

This is a contagious disease of horses, asses, and mules, which is caused by a germ at present known as *Malleomyces mallei* (*Bacillus mallei*.) It is characterized by the formation of tumorlike swellings or nodules in the nasal passages, trachea, lungs, and other internal organs and in the skin. The nodules degenerate into ulcers, having a more or less characteristic discharge. The chronic form of the infection is more common, but there is an acute type of the disease. Although the terms "glanders" and "farcy" are synonymous, the former is usually used in referring to the disease when the local lesions predominate in the internal organs, especially in the nostrils, lungs, and air tubes, and the latter is applied to it when the principal manifestation is an outbreak of the lesions on the exterior or skin of the animal. The term "glanders" applies to the disease in both forms, whereas the term "farcy" is limited to the visible appearance of external trouble only; but in the latter case internal lesions practically always exist, although they may not be evident.

Glanders is readily communicable to man, the dog, the cat, the rabbit, and the guinea pig. It is transmitted with difficulty to sheep and goats, and cattle seem to be entirely immune. It runs a variable course and usually produces the death of the animal affected with it. The disease is accompanied with a variable degree of fever, according to the rapidity of its course. It is subject to various complications of the lymphatic glands, lungs, testicles, internal organs, and subcutaneous connective tissue.

History.—Glanders is one of the oldest diseases of which there is definite knowledge in the history of medicine. Absyrtus, the Greek veterinarian in the army of Constantine the Great, described it with considerable accuracy and recognized its contagious character. Another Greek veterinarian, Vegetius Renatus, who lived in the time of Theodosius (381 A. D.), described, under the name of "mal-



Haines.

GLANDERS.

Nasal septum of horse, right side, showing acute lesions.



Haines.

GLANDERS.

Middle region of nasal septum, left side, showing ulcers.



Haines.

GLANDERS.

Posterior half of nasal septum, right side, showing cicatrices.

leus humidus," a disease of the horse characterized by a nasal discharge and accompanied with superficial ulcers. He recognized the contagious properties of the discharge of the external ulcers and recommended that all animals sick with the disease be separated at once with the greatest care from the others and be pastured in separate fields, for fear the other animals should become affected.

Extensive outbreaks of glanders are described as prevailing in the great armies of continental Europe and England from time to time during all the wars of the last few centuries.

Glanders was introduced into North America at the close of the eighteenth century, and before the end of the first half of the last century had spread to a considerable degree among the horses of the Central States and the immediately adjoining Southern States. This disease was unknown in Mexico until carried there during the Mexican War by diseased horses of the United States Army.

Throughout history, the greatest prevalence of the disease has been during times of war when large numbers of horses were brought together under conditions that allowed the spread of the disease. Thus again, during World War I, losses due to glanders were severe in the armies of many of the combatant countries. However, the precautions taken by some armies effectively controlled the disease for the first time in history. Since the war, diligent application of quarantine and eradication measures has been rewarded in many countries. Even before World War I, progress was being made in the United States and, at present, the disease is practically unknown in this country. However, despite the rigid inspection and quarantine laws that exist throughout the States, the disease may appear from time to time from outside sources. This description of the disease is given so that it may assist in the prompt discovery and proper disposal of affected animals, thus preventing spread of the disease to other animals or man.

Methods of infection.—Generally speaking, the disease is spread from diseased to healthy animals by the transfer of the discharges from the nostrils, lungs, or skin. These contaminate feed, water, mangers, feed boxes, stable equipment, and other articles, even clothing, through which susceptible animals or man coming in contact with them contract the disease. The germ of glanders is not known to live longer than 2 to 3 months outside the animal body and then only under most favorable conditions. The actual means by which the germ enters the body is generally believed to be most commonly the mouth, but the infection may gain entrance by inhalation or through abrasions and cuts in the skin or mucous membranes. Carnivorous animals become infected by eating diseased meat. This is one of the many dangers that exist when horses dead of undetermined disease are not properly disposed of by burning or deep burial. When

infection is acquired by way of the mouth in the horse, the first seat of the disease is usually the lungs, from which the process commonly spreads secondarily to the trachea or other organs. Some observers have held that the liver, intestines, or spleen becomes primarily infected. There appears to be considerable variation in the readiness with which individual cases of the disease spread the infection. This depends on the stage of the disease and its extent but, for all practical purposes, all affected animals are to be considered capable of spreading the disease at any time during their lives.

In cases experimentally produced by the inoculation of glanders discharges or glanders bacilli (*Malleomyces mallei*), the period of incubation may be as short as 3 to 5 days. A case of natural infection with an incubation period of 7 days has been reported but, as a general rule, several weeks or months usually elapse before symptoms of the disease develop.

Symptoms.—These are variable, depending on the course of the disease in individual cases. They vary also according to the form of the disease, which may be a chronic pulmonary form, chronic nasal, chronic skin, or the acute systemic form. During the interval when the bacilli circulate in the blood a rise in temperature of variable extent may be seen. This may appear at the time the infection first gains access to the body or at subsequent periods during the course of the progressing disease.

In chronic pulmonary glanders, the affected animals may spread the disease for considerable periods of time before characteristic symptoms of the disease develop. However, if the temperatures of such animals are regularly taken, intermittent periods of fever are often detected. A dry, harsh cough may be present. The symptoms of heaves and general unthriftiness are commonly seen. Most cases show a discharge of mucous or purulent material from one or both nostrils, which may or may not contain clots of blood. This is at times so mild as to escape particular notice; at other times it may be profuse or appear only after snorting or coughing. In these cases, recurrent hemorrhage from the nose for which no other reason can be given is particularly suggestive of glanders. Various changes in the lung tissue may be detected by the veterinarian through the use of the stethoscope or by percussion. Practically all these cases sooner or later develop lesions of the disease in the nostrils or in the skin.

Since the primary lesions of glanders usually develop in the lungs, the disease, practically speaking, never develops primarily in the membranes of the nose. In chronic nasal glanders, the disease begins inconspicuously with signs of nasal catarrh, which gradually increases in amount and grows more profuse as the disease nears the nostrils. Finally, the nostrils themselves show grayish-yellow nodules the size of hemp seeds, which are surrounded by a reddened area. These

break and form ulcers that to the experienced eye are rather characteristic. The ulcer penetrates deeply into the tissues and presents a "punched-out" or craterlike appearance and has a purulent discharge. Numbers of these ulcers spread into each other and finally form large deep lesions with irregular but still distinct, raised margins (pl. XLI). The discharge, when it becomes profuse, usually has a greenish-yellow color and often contains masses of white substance, resembling cooked white of egg, and blood clots. The lymph nodes under the jaw or in the region of the throat commonly enlarge, at first being painful but later not sore on pressure. If the ulcers in the nasal cavity heal, a rather characteristic scar appears; it is well described as star shaped (pl. XLII). During the development of these lesions in the nose, nodules of the skin, often spoken of as farcy, commonly appear.

In chronic skin glanders, the nodules (farcy buds) rapidly appear under the skin and soon form abscesses that vary from $\frac{1}{4}$ to 1 inch in diameter. Finally, these rupture and discharge their purulent contents, which have the appearance of dark honey. The ulcers that then develop are rather deep and ragged, raw, and bleed easily. Under antiseptic treatment some such ulcers may heal, but it is obvious that the disease still exists as it persists in breaking out in other regions. The lymph nodes and surrounding tissues, including the testicles in stallions and the udder in mares, often become edematous. The first skin lesions are usually found on the inside of the hind legs but may appear elsewhere, as on the sides of the chest or the belly. In the course of the disease edematous swellings of the penis, prepuce, and abdomen commonly develop.

Acute glanders is the form that the disease usually takes when an animal is intentionally inoculated and in nature occurs more often in mules and asses than in horses. The natural disease usually terminates in an acute attack following the chronic disease. This begins with chills and an abrupt rise in temperature that may reach 106° to 107° F. Rapidly spreading ulcers and profuse discharges develop (pl. XL). The edema of the lymph nodes and lymph vessels and the other tissues becomes especially severe. Death occurs in a comparatively short time from exhaustion or sometimes as a result of heart weakness or brain involvement.

Diagnosis.—A review of the symptoms seen in various forms of this disease readily shows that it might easily be confused by the uninformed person with strangles, influenza, purpura hemorrhagica, pseudoglanders, and many other diseases. Even an experienced veterinarian sometimes finds it difficult to make a definite decision in some cases. Fortunately, he has recourse to several procedures by which the disease may be definitely diagnosed. These are all technical procedures that cannot be applied by a person other than one

specially trained. A brief description of each will, however, be of interest and value to the horseman. First, there is the mallein test, which consists in the injection, under or into the skin or into the sac formed by the eyelids, of mallein. Mallein is the repeatedly sterilized and concentrated and filtered fluid upon which the bacillus of glanders has been grown. When it is injected into an animal having glanders, a reaction, indicated by swelling, fever, and discharge according to the seat of the inoculation, develops. The degree of accuracy of the test is indicated by its general use by veterinarians throughout the world. In the United States it is used by the Department of Agriculture, the Army, and the various State livestock sanitary authorities for the purpose of detecting glandered animals.

Another method of diagnosing this disease is the complement fixation test. This is applied by highly technical means, in specially equipped laboratories by trained persons, using serum from blood collected from the suspected animal. In addition to its use as a confirmatory test for the mallein test, it is sometimes used alone.

Other tests rarely employed are those in which the discharges or tissues from the diseased animal are inoculated into laboratory animals (usually the guinea pig) or are cultured to obtain a growth of the glanders bacillus. Both are highly accurate under suitable conditions but have been largely replaced by the other tests mainly in order to avoid the dangers of laboratory workers becoming infected.

Prevention.—As a result of the enforcement of inspection and quarantine laws and the use of the special diagnostic tests, glanders is now rarely found in the United States. Therein lies the principle of effective prevention of glanders. Every horseman is urged to co-operate wholeheartedly in the enforcement of the laws and regulations designed to protect against glanders. Any suspicious case should be promptly reported to a practicing veterinarian, the State veterinary sanitary authorities, or the United States Department of Agriculture. In case a positive diagnosis is made, proper supervision of the disposal of the dead animal, disinfection, and other necessary precautions will be freely given by any of these agencies.

Treatment.—There are a few recorded cases in which this disease has been so retarded by medicinal treatment as to render an animal servicable for months and even years. Nearly always, however, the animal eventually dies of the disease and in the meanwhile it has endangered not only other horses but also man. Therefore, treatment should not be attempted. In fact, it is illegal in most States in this country.

INFECTIOUS LYMPHANGITIS (PSEUDOFARCY, SPOROTRICHOSIS, MYCOTIC LYMPHANGITIS)

This is an infectious inflammation of the lymph vessels that affects the legs, particularly, of horses and tends to become chronic. It is

referred to as mycotic when fungi or moldlike organisms such as *Blastomyces farciminosus* (*Saccharomyces farciminosus*, *Cryptococcus farciminosus*), or species variously classified as *Sporotrichum* or *Streptothrix* are involved. Infectious lymphangitis due to bacteria is attributed to the Preisz-Nocard bacillus (*Corynebacterium ovis*), which is a widely distributed germ that causes so-called pseudotuberculosis in sheep and goats and wild ruminants. Recently, this germ has been identified as the cause of abscesses in horses and cattle in Montana. The infections by *Blastomyces* organisms are referred to in various parts of Europe and Asia as epizootic lymphangitis, whereas in the United States the disease, although spread over considerable areas at times, has never assumed the form of an epizootic. Sporadic cases of *Sporotrichum* infection in horses have been considered by some to be due to the same organism that causes serious lymphatic infections in man. Infectious lymphangitis due to the Preisz-Nocard bacillus, known as ulcerative lymphangitis, was particularly troublesome in several of the armies during World War I, and sporadic cases are reported from time to time in North America as well as other portions of the world.

Symptoms.—Generally speaking, whether the cause of the disease be bacterial or mycotic, there is a more or less gradual filling of the lymph structures, terminating in nodules from the size of a pea to that of a hen's egg. Finally these rupture and form ulcers. With these there may be considerable edema of the skin and the tissues beneath. More commonly, the lesions form on the legs, usually the hind legs. In other cases, however, they may appear on the sides of the body, the neck, or even the head or other parts exposed to injury. Between the nodules, the lymph vessels become corded in appearance and, depending on the nature of the causative agent and the stage of the disease, there is more or less soreness in the affected parts.

The discharge that appears varies from a more or less clear, yellowish fluid to a thick, granular, sticky pus. The lymph nodes of the part frequently are swollen, and considerable infiltration of the affected part may occur. If the mucous membranes of the head or other parts of the body become affected, changes similar to those in the skin appear. The general condition of the animal often is not immediately greatly affected. Sometimes, however, progressive weakness and loss of weight occur, attended by varying degrees of rise in temperature, in some cases to 105° F. Such animals gradually become weaker, and death eventually follows.

Diagnosis.—This disease is to be differentiated from simple lymphangitis on the one hand and true glanders on the other. In case it is neither of these, the nature of the causative organism, whether bacterial or moldlike in nature, should be determined, whenever possible.

Simple lymphangitis, commonly known as "stocking," "filling," and other nonspecific names, is usually observed in heavy-legged, coarse, draft-type horses that are stabled, without exercise, often in unclean stalls. This form of disease is attributed primarily to poor or sluggish circulation of blood and lymph, induced at least in part by lack of exercise while receiving full rations. As a rule the condition can be controlled by proper regulation of the diet and exercise, but it may be complicated by various pus-forming organisms that enter through abrasions or wounds such as those in thrush, scratches, or cracked heels. Glanders can be differentiated from lymphangitis due to other causes by means of one or more of the several tests mentioned in the discussion of that disease. Microscopic examination of the discharges from cases found not to be glanders may permit a conclusion as to whether the lymphangitis is due to bacteria or to fungi, but the determination of the exact nature of the infection usually depends on the growth of the organism present and its study in the laboratory.

Prevention.—Since it is the general opinion that the various micro-organisms causing infectious lymphangitis reach the lymphatic system through wounds of one sort or another, every wound, whether a small, apparently insignificant scratch or a more extensive lesion, should be promptly and regularly treated antiseptically until healing takes place. To be safe, every case of lymphangitis that does not promptly respond to the general care suggested under simple lymphangitis should be isolated and handled as a case of infection until the exact nature of the disease can be determined. Such cleaning and disinfection of the premises as are advised by the veterinarian should be assiduously applied.

Treatment.—Whatever treatment is given should be begun early in the course of the disease. Treatment depends much on the nature of the cause as well as on the extent to which the disease has developed at the time treatment is undertaken. Generally speaking there is no absolutely proved remedy for any of the several forms of the disease. Such treatment as is used must therefore be more or less experimental. But once the cause has been determined in a given case, certain lines of procedure may be given preference over others. Decisions on such points cannot be outlined adequately in a work of this character. There is often a tendency for some of the ulcers to heal, forming a considerable scar, but later new nodules and ulcers appear, showing that the infection has not yet been brought under control. Although some cases respond to surgical removal of the first few nodules that appear or to incision, drainage, and antiseptic treatment, others in which the disease is advanced might well be destroyed for economic and humane reasons.

ANTHRAX

Synonyms: Splenic fever, splenic apoplexy, etc.; charbon (French); Miltzbrand (German).

Anthrax is a severe and usually fatal infectious, febrile disease of livestock, characterized by rapid onset, chills, great depression and stupor of the animal and a profound alteration of the blood. It is caused by a specific micro-organism or germ known as the anthrax bacillus (*Bacillus anthracis*) which is indigenous to the soil in certain areas wherein it survives for long periods, especially in areas that are subject to periodic inundations or in low-lying marshy land. Being a disease indigenous to the soil, anthrax is more or less confined to certain districts, where it occurs almost every year; such areas are commonly designated as "anthrax districts." In such districts the disease makes its appearance during a more or less definite period of the year, usually in the summer, such periods being referred to as the "anthrax season." Isolated cases, however, may occur at any time, including the winter months when stock are not on pasture.

The organisms in their active state (vegetative forms) are cylindrical in shape and grow in the presence of air. When they gain access to the animal body they multiply rapidly and invade the blood stream, producing a rapidly fatal blood infection or septicemia.

Practically all animals are susceptible to anthrax. The horse is susceptible, although not so much as sheep and cattle. Man, the dog, and other omnivora and carnivora may be attacked by it in a constitutional form as fatal as in the herbivora, but fortunately in many cases only local trouble develops followed by recovery.

Since anthrax-contaminated soil is the source of the disease in livestock, most outbreaks occur when the animals are on pasture. It has been observed that hot, dry summers with scant growths of pasture, necessitating grazing close to the soil, are frequently followed by unusually large numbers of cases of anthrax. Likewise, a period of rainy weather followed by warm days appears to favor the occurrence of the disease. It is also a well-known fact that heavy losses from anthrax often follow in the wake of floods and periodic inundations of low-lying land.

Causes.—The causes of anthrax were for a long time attributed entirely to climatic influence, soil, and atmospheric temperature, and they are still recognized as predisposing factors in the development of the disease. However, it is now generally considered that anthrax infection for the most part occurs by way of the digestive tract. Spore-laden soil is taken in with the feed principally while the animal is on pasture, although hay harvested from anthrax-contaminated lands may harbor virulent spores and cause the disease in stable-fed animals.

Contaminated drinking water is also a potent source of infection. Water may become contaminated through the surface drainage of anthrax lands or from the carcasses of animals that died of anthrax, especially when they lie close to or in an upper branch of a stream or in a pond. Streams contaminated with surface drainage from anthrax-infected land or by carcasses of animals dead of anthrax may convey the germs many miles downstream, infecting the territory through which they pass.

Infection may also occur by way of the skin through anthrax spores from the soil lodging in wounds and abrasions or through punctures made by biting insects that had previously fed on a diseased animal. Anthrax organisms may penetrate the unbroken skin, reach the deeper structures, and set up infection. Such evidence has been obtained in human cases at least. Infection also may take place through the respiratory tract, the inhaled spores setting up a rapidly fatal form of pneumonia. This form of anthrax is recognized in man more often than in the lower animals.

Dogs and other carnivores, as well as the carrion-eating animals, birds, and insects, are potential spreaders of anthrax from one area to another.

Some of the biting flies must be considered as potential spreaders of anthrax, since experimentally virulent anthrax organisms have repeatedly been found in or on the bodies of flies taken from carcasses of animals dead from anthrax. It has also been observed that the most severe outbreaks of the disease usually occur during the height of the fly season and that the spread of the disease seems to be most rapid in those areas where flies are most numerous.

Symptoms.—According to the course of the disease, anthrax is recognized in three forms: A peracute form, in which the interval between the first outward manifestation of symptoms and death is but a few hours or even minutes; an acute form, in which the disease lasts for a day or two; and a subacute form, in which the period between first symptoms and death or recovery extends beyond several days.

In the peracute form of the disease, death occurs so quickly that clinical symptoms are often not observed. In the great majority of instances animals that when last seen were apparently in perfect health are found dead. Less often a seemingly healthy animal is seen to fall to the ground, go through a few convulsive movements, and die. Closer examination frequently shows blood-stained discharges from the nose, mouth, and anus. Sudden death in horses, as well as in cattle and sheep, in areas where anthrax previously existed should always be viewed with suspicion and the owner should be on the lookout for anthrax.

In horses and mules the course is usually acute or subacute. The first indication of disease may be severe colicky symptoms accompanied with the passage of blood-stained feces. Hot, painful, and rapidly progressing swellings frequently develop over the body, especially about the neck, lower abdomen, and external genitalia. Hemorrhages may be seen on the visible mucous membranes. There are loss of appetite, elevation of the body temperature, chills, extreme depression, and muscular weakness. Shortly before death respiration becomes extremely labored, the mucous membranes take on a bluish cast, and the temperature falls below normal. Occasionally carbuncles of the skin or anthrax of the tongue may develop. The disease usually terminates in 12 to 24 hours but sometimes lasts 3 to 8 days. Anthrax in the horse may be confused with colic, septicemia, acute swamp fever, purpura hemorrhagica and other acute conditions.

In man, anthrax usually occurs as a primary localized infection of the skin in the form of a carbuncle or as an infection of the lungs known as woolsorter's disease. Skin infections result from the handling of carcasses of animals dead of anthrax or the hides, hair, or wool from such carcasses. Originating as localized infections in the form of small pimples, the lesions may develop rapidly and terminate in a fatal septicemia or blood poisoning. Prompt medical attention is very important whenever anthrax infection is suspected.

Carcasses of animals dead of anthrax decompose rapidly and soon become greatly bloated. The natural post mortem stiffening of the muscles is incomplete. Dark blood escapes as a rule from the natural openings, and the visible mucous membranes are dark blue in color and frequently show hemorrhages. The blood is considerably darker than normal, does not clot readily, and is frequently spoken of as being tarry. Hemorrhages beneath the skin are common; clear or somewhat blood-tinged gelatinous exudates are found between the muscles and beneath the skin, especially in the areas where the swellings were seen before death. Somewhat similar swellings are observed in malignant edema and purpura hemorrhagica in horses.

Diagnosis.—When an animal dies within an anthrax district or on or near premises where the disease has appeared previously, it is important to know definitely whether the death was due to anthrax. Lack of such information has often been responsible for heavy losses of livestock and, at times, the loss of human lives. Whenever there is a possibility of anthrax, it is advisable to have the cause of death determined by a competent veterinarian. If local veterinary service is not available the State livestock sanitary officials should be consulted.

In peracute anthrax, death is so sudden and clinical symptoms are so meager that a definite diagnosis is impossible without the aid of

laboratory examination. Cerebral hemorrhage, lightning stroke, sunstroke, lead poisoning, or some acutely fatal digestive disturbance may be confused with peracute anthrax especially if it occurs in the so-called anthrax districts. In all cases, the post mortem examination should be made by the veterinarian. The danger to the livestock owner from opening a carcass is great owing to the likelihood of his contracting the disease when the body is opened and discharges from it escape.

When a laboratory examination is desired, suitable specimens should be collected by a veterinarian, if possible. In case professional services are not available and the samples are to be collected by others, great care should be taken by the operator to prevent infecting himself. Heavy rubber gloves should be used to prevent the infectious material from coming in contact with the hands.

A few drops of blood deposited in a small wide-mouthed bottle or jar and the container rolled around to spread the blood in a thin film that will dry quickly on the bottom or side walls makes a satisfactory specimen for bacteriological examination. Larger quantities of blood are unsatisfactory in that putrefaction may set in and destroy any anthrax organisms that may be present. Furthermore, the forwarding of larger quantities of such blood by common carrier is a dangerous procedure. The few drops of blood that are required may be collected from a small cut made over the jugular vein or at the base of the ear immediately before the carcass is buried or cremated. The blood may be absorbed by small pieces of blotting paper, chalk, or sterile cotton swabs, which should be allowed to dry and then placed in a sealed container. The container should be enclosed in an unbreakable outside receptacle, such as a metal mailing tube, for shipment to the laboratory for examination.

Another method of obtaining a specimen, but a less satisfactory one, is as follows: remove an ear, place it in a tight container, and pack it in a strong box for shipment to the laboratory. As in the case of large quantities of blood, however, there is danger of putrefaction setting in.

After the samples are collected, it is advisable to destroy the operating knife with the carcass and thoroughly disinfect the hands and arms with a solution of 1 part bichloride of mercury to 1,000 parts of water. This solution should be mixed in and used from a wooden bucket or stoneware crock. As this disinfectant, if swallowed, is very poisonous to man and animals, precautions should be taken accordingly.

No attempts should be made by the layman to collect specimens of the internal organs. The body cavities should be opened only by an experienced veterinarian who is able to protect himself and the premises should the animal's death be due to anthrax.

When a diagnosis of anthrax has been made, the following measures are generally recognized as the most effective means of control: (1) The prompt and proper disposal of animals dead of the disease, together with all the manure, bedding, blood-stained soil, etc., either by complete burning or deep burial; (2) a careful examination of the herd for animals showing early symptoms of the disease, the prompt isolation of sick animals, and immediate treatment with large doses of anti-anthrax serum; (3) vaccination of the apparently well animals in the herd as soon as possible for prevention, in accordance with methods recommended by the State livestock sanitary officials and other experienced veterinarians; (4) immediate change of pastures if practicable. (This precaution in itself in many instances has helped to reduce losses. If the outbreak occurs during the fly season, it is best to move the herd at night so that most of the infection-carrying flies will be left behind.); (5) a strict quarantine of premises rigidly enforced, to prohibit positively the movement of livestock or other commodities of a contraband nature from within or into the infected area.

Disposal of carcasses and disinfection.—In the control of anthrax, prompt and effective disposal of carcasses is of great importance. It is good practice to dispose of all animal carcasses properly, especially in an anthrax area, even though the possibility of anthrax may at the time seem remote. This can be accomplished either by complete cremation or deep burial under a layer of quicklime covered with at least 6 feet of earth. Carcasses should not be buried in low swampy land or adjacent to streams where overflow might inundate the grave, or on a hillside where there is a possibility of subsurface drainage reaching the surface at lower places nearby. The area above and around the grave should be saturated with oil and burned over. The method to be employed will be governed by the prevailing weather conditions and the relative promptness and ease with which each procedure can be carried out at the place where disposal becomes an issue.

In disposing of a dead animal the following method is recommended: Immediately after finding the animal, cover it with kerosene or crude oil to keep flies, dogs, buzzards, crows, and vermin from the carcass until it is disposed of. If conditions permit, cremate or bury the carcass where it is found. If moving to a more suitable site is necessary, take the greatest care to prevent any discharges or hair from contaminating the soil over which the carcass is moved. Consequently, never permit a carcass to be dragged. A stone boat or sled may be used as a means of conveyance. Thoroughly disinfect or burn any equipment used in moving anthrax-infected carcasses. Avoid actual contact with the germ-laden body; this can be done through the use of properly applied ropes and poles, which may then be burned. Prepare a solution of bichloride of mercury to disinfect

the hands and boots or shoes of the operator after the disposal of the carcasses has been completed.

It is advisable, if possible, to have the disposal of anthrax-infected carcasses conducted under the supervision of a qualified veterinarian who from experience can advise on the most effective and economical means of destroying the carcass and disinfecting whatever materials may have become contaminated by the animal or carcass.

When anthrax is prevalent, it is advisable for the owner to keep all his own dogs tied up and to discourage in every possible way stray dogs from coming on the premises. There is always a possibility of such animals having eaten of an anthrax carcass and so becoming spreaders of the infection.

For the same reason action should be taken to protect livestock from the dangers of buzzard and crow roosts. Protection from flies and biting insects so far as practicable is advisable also.

When anthrax occurs in stabled animals, prompt and thorough disinfection of the quarters should follow the removal of the dead animals. Where sick animals are being treated, every precaution should be taken to prevent spread of the infection through contaminated excreta. There is always a possibility of rats or mice transferring contamination to the hayloft or feed storerooms. Therefore, special effort should be made in anthrax districts to get rid of these pests.

Of the disinfectants, lye is one of the most effective. For disinfection of premises against anthrax, a 5-percent solution is recommended. To prepare such a solution $2\frac{1}{2}$ pounds of commercial lye containing 94 percent of sodium hydroxide is dissolved in $5\frac{1}{2}$ gallons of water. Where a whitewash is not objectionable, water-slaked (not air-slaked) lime may be added to the lye solution in the proportion of $2\frac{1}{2}$ pounds of lime to each $5\frac{1}{2}$ gallons of lye solution for the purpose of preventing the transformation of the active principle, sodium hydroxide, into sodium carbonate, which is considerably less effective as a germicide. It is advisable to use the lye or lye-and-lime solution as soon as it is prepared. All places to be disinfected should be thoroughly soaked with the disinfectant, which should be allowed to remain on for at least a day and should then be thoroughly washed off with clean water before the livestock are returned.

Manure from a stable where deaths from anthrax have occurred should be burned or deeply buried or, if this is impracticable, disinfected with liberal applications of a 5-percent solution of lye. However, it is questionable whether any reasonably heavy applications of lye solution would disinfect completely large quantities of manure. It is impossible, therefore, to make general recommendations on the disposal or disinfection of manure that would be efficient

and practicable under all conditions. Methods of procedure, therefore, should be left to the judgment of a qualified veterinarian.

Prevention.—Where anthrax appears more or less regularly each year, vaccination affords the best means of holding the losses to a minimum.

Proper immunization against anthrax is a highly technical problem that involves an understanding of the principles of immunity, as well as expert knowledge of the available immunizing agents, the nature of each product, the immunizing value of each, and its limitations. Anthrax vaccination is, therefore, particularly a procedure that should be under the immediate supervision of a qualified veterinarian.

Where vaccination is necessarily an annual procedure, it should be performed in advance of the anthrax season or at least before anthrax makes its appearance. There is a possibility that vaccination may be followed by an initial state of lowered resistance preceding the establishment of immunity, and exposure to anthrax during this period of increased susceptibility may prove costly. In fact, field observers have frequently witnessed the rapid development of cases of anthrax within several days after vaccination when it was performed after the disease had started. This, it was believed, could have been avoided had the vaccination been performed before the outbreak occurred.

It should be borne in mind, however, that vaccination is not 100 percent effective regardless of the method of vaccination or the vaccine that is used. It is not uncommon for anthrax to develop in an occasional animal even when it is vaccinated with an anthrax biologic that apparently affords protection to the rest of the herd. Whether this is due to the failure of the individual to respond properly to vaccination or whether that particular animal picked up a sufficient number of anthrax spores to break down any degree of immunity cannot be determined. In experimental work in which a number of similarly vaccinated animals are given identical exposures to anthrax, the occasional loss of a properly vaccinated animal seems to point to the failure of the particular individual to respond properly to the vaccination that was given rather than to a fault in the vaccine.

With the knowledge that anthrax vaccination is not 100-percent effective, an occasional loss from anthrax in a vaccinated herd does not constitute grounds for questioning the value of the biologic that was used; neither does it justify hasty revaccination of the herd.

The following varieties of anthrax immunizing agents are now available in the United States: Antianthrax serum, anthrax bacterin, antianthrax serum and anthrax-spore vaccine, single-injection anthrax-spore vaccine (in liquid or pill form), double- or triple-injection anthrax-spore vaccine (in liquid or pill form), anthrax-spore vaccine (intradermic), anthrax-spore vaccine in saponin solution or in alum

solution. The first two of these comprise the sterile anthrax products and the remainder the living-spore anthrax products.

Experience has shown that the living-spore vaccines produce a higher degree of immunity than do the sterile anthrax vaccines. Reports indicate that in recent years the intradermic method of vaccination (with anthrax-spore vaccine) is gradually growing in favor, particularly in badly infected anthrax districts, and that the results obtained from its use have been highly satisfactory.

The selection of the anthrax biologic to be used on a given lot of animals should be left to the local veterinarian or State livestock sanitary officials who, because of their experience and knowledge of the local conditions, are in a position to know which products are best suited to the needs of the herd.

Treatment.—When the progress of the disease is not too rapid, treatment with large doses of antianthrax serum administered by a veterinarian is frequently successful. When used either as a preventive or as a curative there is no danger of giving an overdose of the serum, except in sensitive animals, but there is a possibility of giving quantities that are insufficient to accomplish their purpose. No other known product, drug, or combination of drugs can be depended on to cure an established case of anthrax in animals.

HORSEPOX

Synonyms.—Variola equina; Pferdepocken (German).

The term "horsepox" and the synonyms given above are applied to an infectious, eruptive disease of the skin and mucous membranes. It is more or less generally agreed that the causative filtrable virus is of a nature similar to that of other animal pock diseases, but, as far as is known, not identical with any. It occurs sporadically, chiefly in young animals, where large numbers of horses are gathered together, having been, in past years, more or less common in parts of Europe but not proved to exist in the United States. The disease is described here only because of its historical interest and for the purpose of encouraging those who encounter conditions resembling it to refer the matter to responsible veterinary authorities.

Historically, it is of interest because of the fact that Jenner, the originator of vaccination against smallpox in man, believed the disease to be a form of cowpox. In fact, lymph from the lesions of cases in horses was used for a time in preparing vaccine for the prevention of smallpox. At that time, only the skin lesions, principally in the regions of the pastern, were considered. Later, the disease was recognized to involve mucous membranes as well.

Symptoms.—About 4 to 8 days after exposure to the virus, a slight fever and some depression appear. The eruption that develops may appear on the skin, chiefly at the bend of the joints, usually the pastern,

and in the mucous membranes of the mouth, nose, conjunctiva, or the genital organs. Sometimes it is confined to one of these sites. Again it may spread to several. At first, there is a small, slightly reddened lesion termed a papule. This becomes a blisterlike process (vesicle) and later a pustule. The pustules finally rupture and scabs form. The disease is usually mild, and recovery nearly always is complete in 2 to 3 weeks. The presence of the lesions in the mouth and on the muzzle may make eating painful, and the appetite may decrease. The reddened, sensitive pasterns may at times be responsible for some stiffness and slight lameness. The disease is believed to be spread by contact between diseased and healthy horses, mostly the younger ones. It often develops, however, in mares and stallions after breeding with an animal in which the genital organs are involved.

Diagnosis.—An absolute diagnosis would involve technical inoculation tests for differentiation from vesicular stomatitis, although that disease, in most instances for all practical purposes, can be identified by the trained observer. The disease would require differentiation in some cases from the so-called grease heel that sometimes develops as a result of infections from filth, cracks, and other abrasions in the region of the pasterns and fetlocks. Grease heel is more chronic and generally is associated with a foul odor. Horsepox may be confused with forms of genital disease, including coital exanthema. Lastly it may resemble certain skin diseases such as acne, which develops as a result of infection of the hair follicles by certain pus-forming organisms. In acne the lesions occur mostly where the harness or saddle rubs the body but may cover wide areas.

Prevention and treatment.—Affected animals should be at once isolated and provided with separate grooms and attendants. The stables, as well as buckets, brushes, and similar equipment, should be thoroughly cleaned and disinfected. If treatment is advised, mild antiseptic solutions or emollient preparations are used. Breeding of affected animals should be postponed until recovery is complete.

DOURINE

Dourine (also known as *maladie du coït*, equine syphilis, covering disease, breeding paralysis) is a specific infectious disease affecting under normal conditions only the horse and ass, transmitted from animal to animal by the act of copulation, and caused by an animal parasite, the *Trypanosoma equiperdum*.

History.—It is described as having existed as early as 1796 in the Eastern Hemisphere and was more or less prevalent in several of the European countries, including France, Germany, Austria, and Switzerland, during the first half of the nineteenth century. Its presence was recognized for the first time in the United States in 1886, when an outbreak occurred in Illinois. Since then the existence

of the disease has been observed at irregular intervals in numerous other States, including Iowa, Nebraska, Montana, Wyoming, Nevada, California, New Mexico, Arizona, North Dakota, and South Dakota. The disease is now limited, as far as is known, to a few small areas in the West where horses are still permitted to range in a more or less wild state on the open ranges, but through contact with range animals more confined horses may acquire the disease.

Symptoms.—There are many variations in the symptoms of dourine, and this is particularly true of the disease as it occurs in this country. Two distinct stages may be noted that vary somewhat from those described in textbooks, but probably no more than could be expected when differences of climatic conditions and methods of handling are taken into consideration.

The first stage chiefly concerns the sexual organs and therefore differs somewhat in the male and female. In the second stage the symptoms indicating an affection of the nervous system are more prominent and are not dependent on the sex of the animal.

Following a period of incubation of 8 days to 2 months, there is seen in the stallion an irritation and swelling about the penis and sheath. In a few days small vesicles or blisters may appear on the penis, which later break, discharging a yellowish, serous fluid leaving irregular, raw ulcers. The ulcers show a tendency to heal rapidly, leaving permanent scars. There may be more or less continuous dripping of a yellowish, serouslike fluid from the urethra. Stallions may show great excitement when brought in the vicinity of mares, but service is often impossible because of incomplete erection of the penis.

In the mare the first symptoms may be so slight as to be overlooked. The disease, being the result of copulation, usually begins with inflammation of the vulva and vagina. There may be a muco-purulent discharge, which may be slight or profuse in quantity, matting the hairs of the tail. The mare may appear uneasy and urinate frequently. Vesicles may appear on the external vulva and mucous membrane of the vulva and vagina. These later rupture and form ulcers. On the dark skin of the external vulva the scars resulting from healing of the ulcers are white, more or less circular in outline, from one-eighth to half an inch in diameter, and pitlike. This depigmentation of the skin about the external genitals is permanent.

Urticarial eruptions or plaques that break out over various parts of the body are a frequent symptom in animals of either sex. These are sharply defined and edematous swellings of the skin, about the size of a half dollar or larger. The usual locations of these plaques are the croup, belly, and neck.

The intensity of the symptoms mentioned, which are significant of the early stage of the disease, may vary to a wide extent and in

many instances be so mild as to escape the attention of any but the most careful observer. They commonly disappear after a brief period. The apparent recovery, however, is not permanent, for such animals after a variable period manifest constitutional or nervous symptoms. These may not appear for several months or even years. They consist of a general nervous disorder with staggering, swaying gait, especially in the hind legs. The animal generally becomes emaciated, the abdomen assuming a tucked-up appearance. The first indication of paralysis will be noted in walking when the animal fails to pick up one of the hind feet as freely as the other, or both may become affected at the same time, at which time knuckling is a common symptom. Labored breathing is occasionally noted. When paralysis of the hind legs begins to appear the disease usually progresses rapidly. The horse goes down, is unable to rise, and dies in a short time from nervous exhaustion. The appetite usually remains good up to the last.

Although an animal affected with dourine may now and then recover, as a rule the disease remains in the latent stage. Bad weather, exposure, insufficient feed and complicating diseases such as influenza, distemper, or in fact any condition that tends to lower the vitality of the animal, may hasten the termination of the disease.

Diagnosis.—The complement-fixation test, in which serum from the blood of the suspected animal is used, furnishes by far the most reliable means of diagnosis and is especially valuable in a chronic affection of this character, when the symptoms manifested are variable and frequently so obscure as to escape observation. This is a laboratory test requiring special facilities and the services of a trained serologist.

Treatment.—Little benefit can be obtained from medicinal treatment, nor is such treatment desirable in this country, where the disease has existed only in restricted areas and where sanitary considerations demand its eradication.

SURRA¹

Surra is not known to occur in the United States but is more or less common in various parts of Africa and Asia and in the Philippine Islands. It is caused by an animal parasite, known as *Trypanosoma evansi*, which lives in the blood and destroys the red blood corpuscles. In general the disease is similar to and belongs in the same general class with tsetse-fly disease, or nagana, of Africa, and mal de caderas, of South America.

Surra is a wet-weather disease, occurring chiefly during or immediately after heavy rainfalls, floods, or inundations.

¹ Acknowledgment is made to Ch. Wardell Stiles, Ph. D., for preparation of the original text.

Surra attacks especially horses, asses, and mules, but it may occur in carabao, camels, elephants, cats, and dogs and has been transmitted to cattle, buffaloes, sheep, goats, rabbits, guinea pigs, rats, and monkeys. Several species of animals have been found to carry the infection, but their susceptibility is often so slight that marked symptoms do not develop. Such animals are important, however, since they carry the trypanosome, thus being a danger to other more susceptible species. No birds, reptiles, amphibia (frogs, etc.), or fish are known to suffer from it. It attacks both male and female animals, young and old.

Surra in equines and camels is said to be an invariably fatal disease, but cattle occasionally recover from it. There is no history of a definite onset of the disease, and the condition is progressive, usually with a number of relapses. The period of incubation may vary somewhat; in experimental cases it is 2 to 75 (usually 6 to 8) days, according to conditions. The duration varies with the species of animal attacked, the age, and general condition. The average duration in the horse is reported at less than 2 months, though some cases may terminate fatally in less than 1 to 2 weeks.

Method of infection.—All evidence now available seems to indicate that surra is strictly a wound disease, namely, that the parasite may enter the body only through a wound of some kind. Apparently by far the most common method is through wounds produced by biting flies whose mouth parts are contaminated with the infected blood of some animal bitten by the same flies shortly before biting the healthy animal. The evidence that flies transmit surra is quite conclusive.

Crows may also transmit the infection by pecking at sores on a diseased animal, soiling their beaks with blood, and transferring this infected blood to a healthy animal. Likewise, if a scratch is made on a horse and then infected blood is rubbed on the scratch, the horse will become diseased. If, in an experiment, infected blood is fed to a healthy animal, the latter may contract surra in case it has an abraded or wounded spot in the mouth; but if no part of the lining of the alimentary canal is wounded, infection does not take place. Thus dogs and cats may contract the disease by wounding the lining of the mouth (as with splinters of bone) while feeding on the carcasses of surra subjects. All available evidence indicates that under normal conditions of pregnancy the disease is not transmitted from mother to fetus.

There is a popular view that surra may be contracted by drinking stagnant water and by eating grass and other vegetation grown on land subject to inundation, but there is no good experimental evidence to support this view. Probably the correct interpretation of the facts cited in support of this theory is that biting flies are numerous around

stagnant water and in inundated pastures, hence, that a great number of possible transmitters of the disease are present in these places.

*Symptoms.*²—The invasion of this disease when contracted naturally is usually marked by symptoms of a trivial character; the skin feels hot, and there may be more or less fever; there is also slight loss of appetite, and the animal appears dull and stumbles during action; in the early stage a symptom sometimes appears that may be the first intimation of the animal's indisposition, and that, as a guide to diagnosis, is of great importance, namely, the presence of a general or localized urticarial eruption. If the blood is examined microscopically it may present a normal appearance; but in most cases a few small, rapidly moving organisms will be observed, giving to the blood, as it passes among the corpuscles, a peculiar, vibrating movement. If the parasite has not been discovered in the blood for several days, the symptoms previously mentioned may be the only ones noticed, and the horse may quickly improve in health and the appetite return. This condition does not last for more than a few days, when the animal is again observed to present a dull and dejected appearance, and on examination well-marked symptoms are found. The temperature is more or less elevated, 101.7° to 104° F.; the pulse full and frequent, 56 to 64 beats a minute; the visible mucous membranes may appear clean, but the conjunctival membranes, especially those covering the membrana nictitans, are usually the seat of dark-red patches of ecchymosis, varying in size in different animals. There are more or less thirst and slight loss of appetite; the animal eats its grain and green grass but leaves all or a portion of the hay with which it has been supplied. At the same time there are slight catarrhal symptoms, including lachrymation and a little mucous discharge from the nostrils.

Occasionally at this period of the disease the submaxillary glands may be enlarged and perhaps somewhat tender on manipulation. One symptom is markedly absent, namely, the presence of rigors or the objective sign of chilliness. There are some swelling and edema of the legs, generally between the fetlock and the hock, which pits but is not painful on pressure, and there may be also some swelling of the sheath at this stage of the disease.

When the fever and concomitant symptoms have been present for a short period, one thing becomes especially noticeable in every animal attacked, namely, the rapid loss of weight. If the blood has been examined microscopically during the second period of fever, at first only a few parasites may have been observed in it, but these increase in number day by day and reach a maximum, where they remain for a varying period or suddenly or gradually disappear during the time when fever is absent.

² This summary of symptoms is based on work by Lingard.

After the fever and the accompanying symptoms have for the second time been present for a few days—the period varying from 1 to 6—the animal will have lost the dejected appearance and will look bright. The temperature has fallen, the visible mucous membranes are clean, and the conjunctival petechiae begin to fade. The pulse, however, will be weak and thready in character, but the appetite will be excellent. In fact, if it were not for the loss of weight and slight edema of the legs, there would be little to show that the animal was sick. Unfortunately, however, this condition does not continue for any great length of time, for again fever appears, the animal is dull and dejected, and by the following day the visible mucous membranes present a yellow tinge; large ecchymoses, dark in color, appear on the conjunctival membranes, the pulse is full and quick or at times intermittent, and there may be a jugular pulse; the breathing is quickened, and the respirations are shallow.

An animal in this condition may take seven or eight very short inspirations, followed by a much more prolonged and sonorous one; at the same time the breathing is more abdominal than thoracic in character. The swelling and edema may spread from the legs to the under surface of the abdomen. During all this time the appetite will have varied little, and the evacuations will be only slightly altered in character. In the blood a repetition of the previous events takes place; the parasites make their appearance and increase to a maximum and again suddenly or gradually disappear, according to the length of the fever period. These periods, alternating with and without fever, may go on for a considerable time.

The progress of the disease is variable and depends greatly on the condition of the animal attacked, the weak one succumbing rapidly, but each return of the fever brings with it, as a rule, an increase in the severity of the symptoms. There are increased yellowness of the membranes; fresh crops of hemorrhages on the conjunctiva; a collection of gelatinous material at the inner angle, which at times becomes red in color from an admixture of blood and which on microscopic examination is found to contain a varying number of the surra parasites; increased swelling and edema of the extremities and abdomen, which now extends between the forelegs and up the chest. During this time the wasting especially of the muscles of the back and those surrounding the hip joint and the glutei has been steadily progressive.

Toward the termination of the disease the animal is disinclined to move, and when made to do so there is manifest loss of power over the hindquarters, somewhat resembling a slight partial paralysis, and the hindquarters of the animal reel from side to side. Frequently there are paralysis of the sphincter ani and a dilated condition of the anus. These symptoms, taken together, point to some interference

with the normal functions of the spinal cord in the lower dorsal and lumbar regions and are probably due to pressure caused by an exudation within the spinal membranes. In many cases, shortly before death the heart's action becomes exceedingly violent, shaking the body at each beat, so that the sound can be heard at some distance from the animal. In some of these cases the animal may suddenly drop dead; in others the emaciation and weakness become so pronounced that the animal falls to the ground and dies after a short struggle. In other cases, the animal falls to the ground and appears to be suffering from acute pain, struggles violently, sweat covers the body, and respiration is hurried. The struggles soon exhaust the patient's strength, and for a time it lies quiet; soon, however, the struggles commence again and continue until death occurs.

Diagnosis.—This can be established by the demonstration, with the microscope, of the *Trypanosoma evansi* in the blood stream. At times the inoculation of various species of experimental animals may be resorted to. The complement-fixation and other tests with blood serum are the most common means of diagnosis. Such tests must be conducted in specially equipped laboratories by trained technicians.

Treatment.—No completely satisfactory treatment is known, although many arsenical preparations and dyes have from time to time been employed in those countries where the disease is prevalent. Eradication of the disease by slaughter seems to be impractical in most instances in foreign countries, because of the great numbers of wild and domestic animals that carry the infection. There is no biological preparation known that is capable of preventing the disease and, in view of the great economic importance of this disease, it would not be advisable to attempt to treat any sporadic cases should they occur in this country. On the contrary, the animals should be slaughtered immediately and their carcasses promptly burned.

VESICULAR STOMATITIS (CONTAGIOUS SORE MOUTH, EROSION STOMATITIS)

Vesicular stomatitis is an acute, contagious disease, characterized by the formation of vesicles (water blisters) in the mouth. It affects horses and mules chiefly but sometimes occurs in cattle. It has never been observed under natural conditions in sheep or swine.

The disease occurs sporadically from time to time and sometimes becomes enzootic or epizootic. Thus, among horses and mules at remount depots in the Middle West in 1916 many cases occurred. The disease was found in American horses shipped to France during World War I. Outbreaks of considerable proportions have since occurred in California, Colorado, Nebraska, Texas, Wyoming, South Dakota, Minnesota, Wisconsin, Indiana, New Jersey, Virginia, and West Virginia.

Cause.—The specific cause is a filtrable virus, which at various times in the course of the disease is present in the blood and the coverings and the contents of the vesicles. Two types of the virus have been identified, the Indiana type and the New Jersey type. An attack of the disease due to either type results, on recovery of the affected animal, in immunity against the same type of virus but not against the other. The two types are thus recognized as immunologically distinct entities, though the clinical symptoms are essentially indistinguishable regardless of which type of the virus induces the disease.

Symptoms and lesions.—The first indication of vesicular stomatitis is the formation of reddened patches on the mucous membrane of the mouth, especially of the tongue. These are quickly succeeded by vesicles or blisters of grayish-red color, only slightly elevated, and of various sizes from that of a dime to the size of a silver dollar, filled with clear or yellowish serous fluid. These blisters may be isolated, but frequently they coalesce to form a large vesicle. They usually rupture in a short time, which accounts for their not being recognized at times even in the early stages of the disease. The rupture of the vesicles results in exposing the raw underlying surfaces, which appear as reddened erosions with the grayish-white fragments of the torn mucous membrane of the preexisting vesicles still attached to the irregular borders like a fringe. These erosions may become confluent, varying from the size of a dime to that of the palm of the hand and may even involve practically the entire upper surface of the tongue in horses. Healing varies but usually occurs rapidly in 8 to 15 days in uncomplicated cases.

Although these lesions in horses are principally confined to the upper surface of the tongue, they may involve the inner surface of the lips, the angles of the mouth, and the gums. In cattle, lesions may occur on the tongue, hard palate, lips, and gums, sometimes extending to the muzzle and around the nostrils. Often the lips of the horse are swollen and itchy, which causes the animal to rub the muzzle against any nearby object. In a few cases, fresh cows have shown similar lesions on the teats when their infected calves have been sucking them.

Although foot lesions were reported to occur in horses by Captain Burton, of the English Army Veterinary Corps, in 1917, and although they have been produced by Bureau investigators in the feet of both horses and cattle in a few cases by inoculation, no lesions on the feet, in either of these animals, due to natural infection, were observed in the United States in the outbreaks occurring before 1925. Since then, however, a few cases in which foot lesions developed in cattle have been observed. In nearly all these cases the lesions were confined to a single foot of the affected animal. The lesions consisted of a large

vesicle in the interdigital space and extended over its entire area. Other vesicles appeared around the coronet. In some of the affected feet there was considerable separation of the horny from the deeper structures at the heels. The lesions of the feet were practically identical in appearance with those of foot-and-mouth disease, but, unlike them in the cases observed, were confined to one foot. Furthermore, only a small proportion of affected animals had lesions of the feet, whereas in foot-and-mouth disease the feet, as well as the mouth, usually become affected.

Immediately before or simultaneously with the appearance of the vesicles, the animal is usually depressed and there is a rise of temperature, which rapidly subsides after the vesicles rupture. A more or less profuse flow of saliva follows, which dribbles from the lips and consists of a thin, stringy, or frothy fluid. Frequently, the presence of salivation is the first indication that the animal is sick. Owing to the painful condition of the mouth at this stage there is loss of appetite or at least inability to eat, and in horses "gritting" of the teeth is frequent, whereas in cattle "smacking" noises are heard as in foot-and-mouth disease. This sensitiveness as a rule remains for several days, after which healing commences unless complications set in. It is remarkable how quickly the sick animals will begin to eat even while their tongues are still eroded. Although eating well, they do not regain their original thrifty appearance for some time. In dairy cows, in addition to shrinkage in flesh, there is a noticeable reduction in the normal flow of milk for a few days.

According to field observations, the period of incubation of vesicular stomatitis, following natural exposure, varies from 36 hours to 9 days, but the greatest number of cases occur 2 to 5 days after exposure. Following inoculations, vesicles are seldom more than 48 hours in appearing, are usually present after 38 to 44 hours, and occasionally appear in 24 hours. The temperature begins to rise between the eighteenth and twenty-fourth hours and may reach 105° or even 107° F. in cattle.

No losses have been reported from uncomplicated cases of this disease in horses, mules, or cattle. A certain proportion of horses and mules having vesicular stomatitis may become infected with influenza or contagious pneumonia, or other diseases, and some deaths have occurred among such animals.

Contagiousness.—The degree of contagiousness varies between wide limits. Experiments have proved that the disease is most readily transmissible at the time the blisters rupture or shortly thereafter, but when the lesions are 5 or 6 days old the virus of the disease has practically disappeared. This may account for the differing results investigators sometimes have in their attempts to transfer the disease artificially.

Investigations indicate that the disease is seldom communicated by owners or caretakers of affected animals visiting other farms. As a rule the disease appears to spread by direct contact with recently affected animals or by recently infected feed troughs, water troughs, bridles, or pails.

Diagnosis.—When vesicular stomatitis occurs in cattle, it may be difficult to distinguish from foot-and-mouth disease, that dreaded scourge which, except for occasional appearances, has been kept out of the United States. The filtrable viruses of foot-and-mouth disease and vesicular stomatitis can, however, be distinguished by animal inoculation and other tests. An additional difference of practical importance is that horses have never been found naturally infected with foot-and-mouth disease. The real difficulties surrounding the diagnosis are best appreciated by those who have faced them with the consciousness that their pronouncement, if mistaken, would lead, on one hand, to unnecessary and serious economic disturbances and, on the other hand, to the spread of the most dreaded and easily communicated animal plague. Vesicular stomatitis, therefore, will prove a menace whenever and wherever it may appear. For these reasons it is strongly urged that all owners and handlers of horses, mules, and cattle, particularly dealers, managers of stockyards, and stockmen, should immediately bring affected animals to the attention of their veterinarian and/or State livestock sanitary authorities. The sick animals should be separated from the well ones, contaminated premises cleaned and disinfected, and all infected animals appropriately treated.

In horses, vesicular stomatitis must be differentiated from contagious pustular stomatitis, or horsepox. Stomatitis, or inflammation of the mouth, may also occur as the result of feeding excessively rough fodder, or from foreign bodies, dental abnormalities, unsuitable bridle bits, excessive administration of some drugs, or irritants, or caustic chemicals such as lye, unslaked lime, ammonia, and acids. Horses pastured on luxuriant alsike or other clovers sometimes develop what is known as clover disease, of which stomatitis is a prominent symptom. Rusts and other fungi, particularly on leguminous pasture or hay, are believed by some authorities to cause stomatitis. The condition also arises infrequently in the course of some infectious, toxic, or nutritional diseases, such as strangles, purpura hemorrhagica, and rachitis.

Treatment.—The treatment of vesicular stomatitis consists in first removing the affected from the healthy animals and isolating the former until fully recovered. Such isolation, together with the adoption of rigid sanitary precautions, greatly reduces the prevalence of the disease. Medicinal treatment or undue handling of the affected parts should not be attempted until after the true nature of the disease

has been determined, as the lesions may be so mutilated as to make diagnosis difficult. If it is found that animals are affected with vesicular stomatitis and they are gentle enough to be handled, the mouth may be syringed several times a day with a suitable antiseptic solution, or a bucket of medicated water may be provided and the animals allowed to drink or rinse their mouths whenever desired. Hay should not be fed for the first few days, but instead bran or other soft feed should be given. If the animals are handled in this manner and carefully fed, the disease should rapidly disappear.

Horseshoeing

By JOHN W. ADAMS, A. B., V. M. D.

[Revised by GILBERT T. CREECH, D. V. S.]

Bad and indifferent shoeing frequently leads to diseases of the feet and to irregularities of gait, which may render a horse unserviceable. The intelligent horse owner should have a sufficient number of facts, based on experience and on the anatomy and physiology of the foot and leg, to enable him to avoid the more serious consequences of improper shoeing.

As the horse has been largely replaced by automobiles and motor-trucks for both light and heavy road work, the question of shoeing is not so important as it was before the advent of the automobile. Farm work horses, however, should have their feet examined and trimmed regularly to prevent damage due to lack of normal wear of the hoof tissue. Many horse owners allow their work animals to go unshod, especially when they are used largely for working soft ground.

In this connection the advent of hard-surfaced roads and motor vehicles has been accompanied, in most localities, with a great decrease in the number of blacksmith shops. These have become supplanted by gas stations and garages to so great an extent that the problem of shoeing farm horses has become a serious one in many communities. Some farmers have solved this problem by learning to do the work themselves on their own farms. Ready-to-wear shoes of various sizes for horses and mules can now be obtained and greatly simplify the shoeing problem. Many agricultural colleges also give instruction in this work, and it is recommended that farmers apply to them for community demonstrations. The proper trimming and leveling of hoofs, fitting shoes, and nailing them on are much more readily understood if presented in an actual demonstration by a competent horseshoer. However, in the absence of such instruction the information here presented will familiarize horse owners with the anatomy of horses' feet and the essential requirements of good shoeing whether done, preferably, by a trained horseshoer or, through necessity, by the owner of the horse.

GROSS ANATOMY OF THE FOOT

(Pls. XXXII-XXXIV)

The bones of the foot are four in number, three of which—the long pastern, short pastern, and coffin bone, placed end to end—form a continuous straight column passing downward and forward from the

fetlock joint to the ground. A small accessory bone, the navicular, or "shuttle," bone, lies crosswise in the foot between the wings of the coffin bone and forms a part of the joint surface of the latter. The short pastern projects about $1\frac{1}{2}$ inches above the hoof and extends about an equal distance into it. (See also p. 370.)

The pastern and the coffin bone are held together by strong fibrous cords passing between the two bones and placed at the sides so as not to interfere with the forward and backward movement of the bones. The joints are therefore imperfect, hinge joints, owing to the fact that although the chief movements are those of extension and flexion in a single plane, some slight rotation and lateral movements are also possible.

The bones are still further bound together and supported by three long fibrous cords, or tendons. One, the extensor tendon of the toe, passes down the front of the pasterns and attaches to the coffin bone just below the edge of the hair; when pulled on by its muscle this tendon draws the toe forward and enables the horse to place the hoof flat upon the ground. The other two tendons are placed behind the pasterns and are called flexors, because they flex, or bend, the pasterns and coffin bone backward. One of the tendons is attached to the upper end of the short pastern, and the other passes down between the heels, glides over the under surface of the navicular bone, and attaches itself to the under surface of the coffin bone. These two tendons not only flex, or fold up, the foot as the latter leaves the ground during motion, but at rest assist the suspensory ligament in supporting the fetlock joint.

The foot axis is an imaginary line passing from the fetlock joint through the long axes of the two pasterns and coffin bone. This imaginary line, which shows the direction of the pasterns and coffin bone, should always be straight—that is, never broken, either forward or backward when viewed from the side, or inward or outward when observed from in front. Viewed from one side, the long axis of the long pastern, when prolonged to the ground, should be parallel to the line of the toe. Viewed from in front, the long axis of the long pastern, when prolonged to the ground, should cut the hoof exactly at the middle of the toe.

Raising the heel or shortening the toe not only tilts the coffin bone forward and makes the hoof stand steeper at the toe, but it also slackens the tendon that attaches to the under surface of the coffin bone (perforans tendon), and therefore allows the fetlock joint to sink downward and backward and the long pastern to assume a more nearly horizontal position. The foot axis, viewed from one side, is now broken forward; that is, the long pastern is less steep than the toe, and the heels are either too long or the toe is too short. On the other hand, raising the toe or lowering the heels of a foot with a

straight foot axis not only tilts the coffin bone backward and renders the toe more nearly horizontal, but it also tenses the perforans tendon, which then forces the fetlock joint forward, causing the long pastern to stand steeper. The foot axis, seen from one side, is now broken backward—an indication that the toe is relatively too long or that the heels are relatively too low.

The elastic tissues of the foot are preeminently the lateral cartilages and the plantar cushion. The lateral cartilages are two irregularly four-sided plates of gristle, one on either side of the foot, extending from the wings of the coffin bone backward to the heels and upward to a distance of an inch or more above the edge of the hair, where they may be felt by the fingers. Normally, these plates are elastic and yield readily to moderate finger pressure, but from various causes may undergo ossification, or bony changes in which condition they are hard and unyielding. The plantar cushion is a wedge-shaped mass of tough, elastic, fibrofatty tissue filling all the space between the lateral cartilages, forming the fleshy heels and the fleshy frog, and serving as a buffer to disperse shock when the foot contacts the ground. It extends forward underneath the navicular bone and perforans tendon and protects these structures from injurious pressure from below. Photographs show that the horse, when running, sets the heels to the ground before other parts of the foot—conclusive proof that the function of this tough, elastic structure is to dissipate and render harmless violent impact of the foot with the ground.

The horn-producing membrane, or "quick," as it is commonly termed, is merely a downward prolongation of the derm, or true skin, and may conveniently be called the pododerm (foot skin). The functions of the pododerm are to produce the hoof and to unite it firmly to the foot. The pododerm closely invests the coffin bone, lateral cartilages, and plantar cushion, much as a sock covers the human foot, and is itself covered by the horny capsule, or hoof. It differs from the external skin, or hair skin, in having no sweat or oil glands, but, like it, is richly supplied with blood vessels and sensitive nerves. And, just as the derm of the hair skin produces on its outer surface layer on layer of horny cells (epiderm), which protect the sensitive and vascular derm, so, likewise, in the foot the pododerm produces over its entire surface soft cells, which, pushed away by more recent cells forming beneath, lose moisture by evaporation and are rapidly transformed into the corneous material called the hoof. It is proper to regard the hoof as a greatly thickened epiderm having many of the qualities possessed by such epidermal structures as hair, feathers, nails, or claws.

There are five parts of the pododerm, easily distinguishable when the hoof has been removed, namely: (1) The perioplic band, a narrow ridge from one-sixteenth to one-eighth of an inch wide, running

along the edge of the hair from one heel around the upper border of the hoof to the other heel. This band produces the perioplic horn, the thin varnishlike layer of glistening horn, which forms the surface of the wall, or "crust," and whose purpose seems to be to retard evaporation of moisture from the wall. (2) The coronary band, a prominent fleshy cornice encircling the foot just below and parallel to the perioplic band. At the heels it is reflected forward along the sides of the fleshy frog to become lost near the apex of this latter structure. The coronet produces the middle layer of the wall, and the reflexed portions produce the "bars," which are, therefore, to be regarded merely as a turning forward of the wall. (3) The fleshy leaves, 500 to 600 in number, parallel to one another, running downward and forward from the lower edge of the coronary band to the margin of the fleshy sole. They produce the soft, light-colored horny leaves that form the deepest layer of the wall and serve as a strong bond of union between the middle layer of the wall and the fleshy leaves with which they dovetail. (4) The fleshy sole, which covers the entire under surface of the foot, except the fleshy frog and bars. The horny sole is produced by the fleshy sole. (5) The fleshy frog, which covers the under surface of the plantar cushion and produces the horny frog.

The horny box or hoof consists of wall and bars, sole and frog. The wall is all that part of the hoof which is visible when the foot is on the ground (fig. 8). It consists of three layers—the periople, the middle layer, and the leafy layer.

The bars (fig. 1c) are forward prolongations of the wall and are gradually lost near the point of the frog. The angle between the wall and a bar is called the buttress. Each bar lies against the horny frog on one side and encloses a wing of the sole on the other, so that the least expansion or contraction of the horny frog separates or approximates the bars, and through them the lateral cartilages and the walls of the quarters. The lower border of the wall of the hoof is called the bearing edge and is the surface that bears against the shoe. By dividing the entire lower circumference of the wall into five equal parts, a toe, two side walls, and two quarters will be exhibited. The "heels," strictly speaking, are the two rounded soft prominences of the plantar cushion, lying one above each quarter. The outer wall is usually more slanting than the inner, and the more slanting half of a hoof is always the thicker. In front hoofs the wall is thickest at the toe and gradually thins out toward the quarters, where in some horses it may not exceed one-fourth of an inch. In hind hoofs there is much less difference in thickness between the toe, side walls, and quarters. The horny sole, from which the flakes of old horn have been removed, is concave and about as thick as the wall at the toe. It is rough, uneven, and often covered by flakes of dead

horn in process of being loosened and cast off. Behind the sole is an opening into which are received the bars and horny frog. This opening divides the sole into a body and two wings.

The periphery of the sole unites with the lower border of the wall and bars through the medium of the white line, which is the cross section of the leafy horn layer of the wall and of short plugs of horn that grow down from the lower ends of the fleshy leaves. This white line is of much importance to the shoer, since its distance from the outer border of the hoof indicates the thickness of the wall, and in the white line that is readily seen on trimming the hoof all nails should be driven.

The frog, secreted by the pododerm covering the plantar cushion or fatty frog, and presenting almost the same form as the latter, lies as a soft and very elastic wedge between the bars and between the edges of the sole just in front of the bars. A broad and shallow depression in its center divides it into two branches, which diverge as they pass backward into the horny bulbs of the heel. In front of the middle cleft the two branches unite to form the body of the frog, which ends in the point of the frog. The bar of a bar shoe should rest on the branches of the frog. In unshod hoofs the bearing edge of the wall, the sole, frog, and bars are all on a level; that is, the under surface of the hoof is perfectly flat, and each of these structures assists in bearing the body weight.

With respect to solidity, the different parts of the hoof vary widely. The middle layer of the wall is harder and more tenacious than the sole, for the latter crumbles away or passes off in larger or smaller flakes on its under surface, whereas no such spontaneous shortening of the wall occurs. The white line and the frog are soft-horn structures and differ from hard horn in that their horn cells do not under natural conditions become hard and hornlike. They are very elastic, absorb moisture rapidly, and as readily dry out and become hard, brittle, and easily fissured. Horn of good quality is fine grained and tough, whereas bad horn is coarse grained and either mellow and friable or hard and brittle. All horn is a poor conductor of heat, and the harder (drier) the horn the more slowly does it transmit extremes of temperature.

PHYSIOLOGICAL MOVEMENTS OF THE HOOF

A hoof while supporting the body weight has a different form, and the structures enclosed within the hoof have a different position than when not bearing weight. Since the amount of weight borne by a foot is continually changing, and the relations of internal pressure are continuously varying, a foot is, from a physiological viewpoint, never at rest. The most marked changes of form of the hoof occur when the foot bears the greatest weight, namely, at the time of the

greatest descent of the fetlock. Briefly, these changes of form are: (1) An expansion or widening of the whole back half of the foot from the coronet to the lower edge of the quarters. This expansion varies between one-fiftieth and one-twelfth of an inch. (2) A narrowing of the front half of the foot, measured at the coronet. (3) A sinking of the heels and a flattening of the wings of the sole. These changes are more marked in the half of the foot that bears the greater weight.

The changes of form occur in the following order. When the foot is set to the ground the body weight is transmitted through the bones and sensitive and horny leaves to the wall. The coffin bone and navicular bone sink a little and rotate backward. At the same time the short pastern sinks backward and downward between the lateral cartilages and presses the perforans tendon upon the plantar cushion. This cushion, being compressed from above and being unable to expand downward by reason of the resistance of the ground acting against the horny frog, acts like any other elastic mass and expands toward the sides, pushing before it the yielding lateral cartilages and the wall of the quarters. This expansion of the heels is assisted and increased by the simultaneous flattening and lateral expansion of the resilient horny frog, which crowds the bars apart. When the lateral cartilages are ossified, not only is no expansion of the quarters possible, but frog pressure often leads to painful compression of the plantar cushion and to increase of lameness. Frog pressure is therefore contraindicated in lameness due to sidebones (ossified cartilages). Under the descent of the coffin bone the horny sole sinks a little; that is, the arch of the sole around the point of the frog and the wings of the sole become somewhat flattened. All these changes of form are most marked in sound, unshod hoofs, because in them ground pressure on the frog and sole is pronounced; they are more marked in fore hoofs than in hind hoofs.

The movement of the different structures within the foot and the changes of form that occur at every step are indispensable to the health of the hoof, so that these elastic tissues must be kept active by regular exercise, with protection against drying out of the hoof. Long-continued rest in the stable, drying out of the hoof, and shoeing decrease or alter the physiological movements of the hoof and sometimes lead to foot diseases. Since these movements are complete and spontaneous only in unshod feet, shoeing must be regarded as an evil, albeit a necessary one, and indispensable if horses are to be continuously serviceable on hard, artificial roads. However, if shoes are used, the branches of which have a wide and level bearing surface so as to interfere as little as possible with the expansion and contraction of the quarters, insofar as this is not hindered by the nails, one need not be

apprehensive of trouble, provided the horse has reasonable work and the hoofs have proper care.

GROWTH OF THE HOOF

All parts of the hoof grow downward and forward with equal rapidity, the rate of growth being largely dependent on the quantity of blood supplied to the pododerm, or quick. Abundant and regular exercise, good grooming, moistness and suppleness of the hoof, going barefoot, plenty of good feed, and at proper intervals removing the overgrowth of hoof and regulating the bearing surface by increasing the volume and improving the quality of the blood flowing into the pododerm, favor the rapid growth of horn of good quality; whereas lack of exercise, dryness of the horn, and excessive length of the hoof hinder growth.

The average rate of growth is about one-third of an inch a month. Hind hoofs grow faster than fore hoofs and unshod ones faster than shod ones. The time required for the horn to grow from the coronet to the ground, though influenced to a slight degree by the previously mentioned conditions, varies in proportion to the distance of the coronet from the ground. At the toe, depending on its height, the horn grows down in 11 to 13 months, at the side wall in 6 to 8 months, and at the heels in 3 to 5 months. A fairly accurate estimate can thus be made of the time required for the disappearance of such defects as cracks or clefts in the hoof.

Irregular growth is not infrequent. The almost invariable cause of this is an improper distribution of the body weight over the hoof—that is, an unbalanced foot. Colts running in soft pasture or confined for long periods in the stable are frequently allowed to grow hoofs of excessive length. The long toe becomes “dished”—that is, concave from the coronet to the ground—the long quarters curl forward and inward and often completely cover the frog and lead to contraction of the heels, or the whole hoof bends outward or inward, and a crooked foot, or, even worse, a crooked leg, is the result if the long hoof is allowed to exert its powerful and abnormally directed leverage for only a few months on young plastic bones and tender and lax articular ligaments. All colts are not foaled with straight legs, but failure to regulate the length and bearing of the hoof may make a straight leg crooked and a crooked leg worse, just as intelligent care during the growing period can greatly improve a congenitally crooked leg. If breeders were more generally cognizant of the power of overgrown and unbalanced hoofs to divert the lower bones of young legs from their proper direction, and, therefore, to cause them to be moved improperly, with loss of speed and often with injury to the legs, there might be fewer knock-kneed, bow-legged, splay-footed, pigeon-toed, cow-hocked, interfering, and paddling horses.

If in shortening the hoof one side wall is left too long or cut down too low with relation to the other, the foot will be unbalanced, and in traveling the long section will touch the ground first and will continue to do so till it has been reduced to its proper level (length) by the increased wear that will take place at this point. Although this occurs rapidly in unshod hoofs, the shoe prevents wear of the hoof, though it is itself more rapidly worn away beneath the high (long) side than elsewhere, so that by the time the shoe is worn out the tread of the shoe may be flat. If this mistake is repeated from month to month, the part of the wall left too high will grow more rapidly than the low side whose pododerm is relatively anemic as a result of the greater weight falling into this half of the hoof, and the ultimate result will be a crooked foot.

THE CARE OF UNSHOD HOOFS

The colt should have abundant exercise on dry ground. The hoofs will then wear gradually, and it will only be necessary from time to time to regulate any uneven wear with the rasp and to round off the sharp edge about the toe in order to prevent breaking away of the wall.

Colts in the stable cannot wear down their hoofs; therefore every 4 to 6 weeks they should be rasped down and the lower edge of the wall well rounded to prevent chipping. The soles and clefts of the frog should be picked out every few days and the entire hoof washed clean. Plenty of clean straw litter should be provided. Hoofs that are becoming awry should have the wall shortened in such manner as to straighten the foot axis. This will ultimately produce a good hoof and will improve the position of the leg.

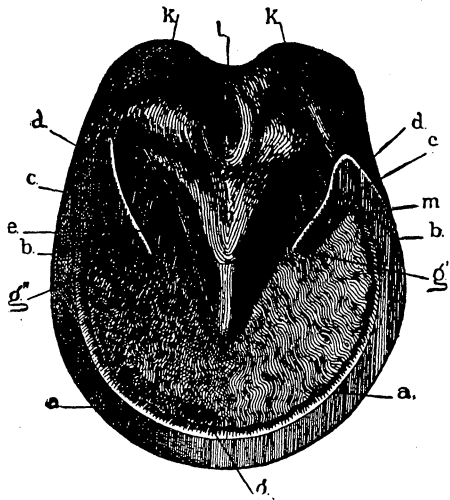


FIGURE 1.—Ground surface of a right fore hoof of the regular form: *a, a*, Wall; *a-a*, toe; *a-b*, side walls; *b-d*, Quarters; *c, c*, bars; *d, d*, buttress; *e*, lateral cleft of frog; *f*, body of sole; *g, g', g''*, leafy layer (white line) of toe and bars; *h, h*, body of frog; *i, i*, branches of frog; *k, k*, horny bulbs of heels; *l*, middle cleft of frog.

CHARACTERISTICS OF A HEALTHY HOOF

A healthy hoof (figs. 1 and 8) is equally warm at all parts and is not tender under pressure with the hands or moderate compression with pincers. The coronet is soft and elastic at all points and does not project beyond the surface of the wall. The wall (fig. 8) is straight

from coronet to ground, so that a straightedge laid against the wall from coronet to ground parallel to the direction of the horn tubes will touch at every point. The wall should be covered with the outer varnishlike layer (periole) and should have no cracks or clefts.

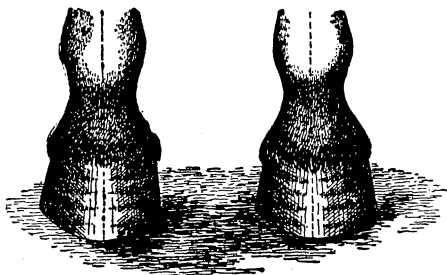


FIGURE 2.—Pair of forefeet of regular form in natural standing position.

Every hoof shows "ring formation," but the rings should not be strongly marked and should always run parallel to the coronary band. Strongly marked ring formation over the entire wall is an evidence of a weak hoof, but when limited to a part of the wall is evidence of previous local inflammation. The bulbs of the heels should be full, rounded, and of equal

height. The sole (fig. 1) should be well hollowed out, the white line solid, the frog well developed, the middle cleft of the frog broad and shallow, the spaces between the bars and the frog wide and shallow, the bars straight from the buttress toward the point of the frog and the buttresses themselves so far apart as not to press against the branches of the frog. A hoof cannot be considered healthy if it has a reddish, discolored horn, cracks in the wall, white line, bars, or frog, thrust of the frog, contraction or displacement of the heels. The lateral cartilages should yield readily to finger pressure.

VARIOUS FORMS OF HOOFS

As among a thousand human faces no two are alike, so among an equal number of horses no two have hoofs exactly alike. A little study of different forms soon will show, however, that the form of every hoof depends in great measure on the direction of the two pastern bones as viewed from the front or behind or from one side, and that all hoofs fall into three classes when viewed from the front and three classes when observed in profile. Inasmuch as the form of every foot determines the peculiarities of the shoe that is best adapted to it, no one who is ignorant of, or who disregards the natural form of, a hoof can hope to understand physiological shoeing.

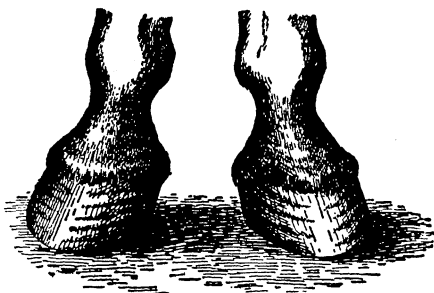


FIGURE 3.—Pair of forefeet of base-wide form in toe-wide standing position.

FORMS OF FEET VIEWED FROM THE FRONT AND IN PROFILE

Whether a horse's feet are observed from the front or from behind, their form corresponds to, or at least resembles, either that of the natural position (fig. 2), the base-wide or toe-wide position (fig. 3), or the base-narrow position (fig. 4).

The direction of the imaginary line passing through the long axes of the two pasterns (figs. 2, 4, 5) determines whether or not the hoof and pasterns are in proper mutual relation.

In the natural standing position (fig. 2) the foot axis runs straight downward and forward. In the base-wide position (fig. 3) it runs obliquely downward and outward, and in the base-narrow position (fig. 4) it runs obliquely downward and inward.

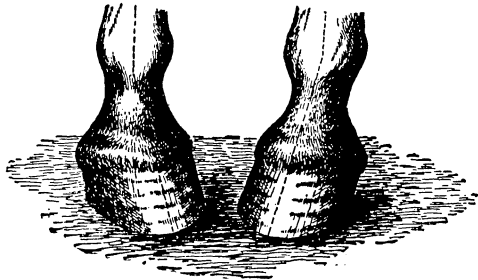


FIGURE 4.—Pair of forefeet of base-narrow form in toe-narrow standing position.

When the foot is viewed in profile, the natural position is distinguished (fig. 5 *b*) and all forward deviations are designated as acute-angled (long toe and low heel, fig. 5 *a*), and all deviations backward from the regular (steep toe and high heel, fig. 5 *c*) as steep-toed, or stumpy. When the body weight is evenly distributed over all four legs, the foot axis should be straight; the long pastern, short pastern, and wall at the toe should have the same slant.

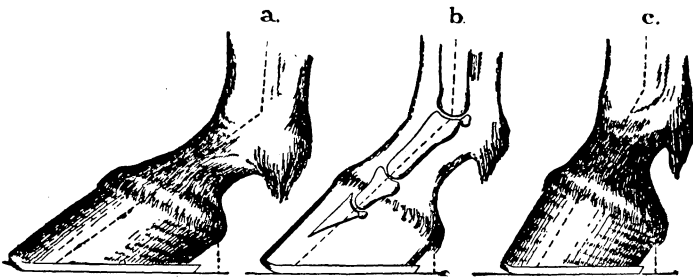


FIGURE 5.—*a*, Side view of an acute-angled forefoot (shod); *b*, side view of a natural forefoot, showing the most desirable degree of obliquity; *c*, side view of a stumpy, or "up-right," forefoot. In *a*, *b*, *c*, note particularly the relation between the length of the shoe and the overhanging of the heels. Note also the toe roll of the shoes.

In front hoof in the natural standing position, the outer wall is a little more slanting and somewhat thicker than the inner. The lower border of the outer quarter describes the arc of a smaller circle—that is, is more sharply bent than the inner quarter. The weight falls near the center of the foot and is evenly distributed over the whole bottom of the hoof. The toe forms an angle with the ground of 45° to 50° and is

parallel to the direction of the long pastern. The toe points straight ahead, and when the horse is moving forward in a straight line the hoofs are picked up and carried forward in a line parallel to the middle line of the body and are set down flat. Coming straight toward the observer the hoofs seem to rise and fall perpendicularly.

A hoof of the base-wide position is always awry. The outer wall is more slanting, longer, and thicker than the inner, the outer quarter more curved than the inner, and the outer half of the sole wider than the inner. The weight falls largely into the inner half of the hoof. In motion the hoof is moved in a circle. From its position on the ground it breaks over the inner toe, is carried forward and inward close to the supporting leg, thence forward and outward to the ground, which the hoof meets first with the outer toe. Horses that are toe-wide (splay-footed—toes turned outward) show all these peculiarities of hoof form and hoof flight to a still more marked degree and are therefore more prone to interfere when in motion.

A hoof of the base-narrow position is awry but not to so marked a degree as the base-wide hoof. The inner wall is usually a little more slanting than the outer, the inner half of the sole wider than the outer, and the inner quarter more curved than the outer. The outer quarter is often flattened and drawn in at the bottom. The weight falls largely into the outer half of the hoof. In motion the hoof breaks over the outer toe, is carried forward and outward at some distance from the supporting leg, thence forward and inward to the ground, which it generally meets with the outer toe. The foot thus moves in a circle, whose convexity is outward, a manner of flight called paddling. Base-narrow feet, with toes pointing straight ahead, frequently interfere, whereas toe-narrow (pigeon-toed) feet seldom do.

A natural hoof (fig. 5*b*), viewed from one side, has a straight foot axis inclined to the horizon at a normal angle. The weight falls near the center of the foot and there is moderate expansion of the quarters.

An acute-angled hoof (fig. 5*a*) has a straight foot axis inclined at a narrow angle less than 45° to the horizon. The weight falls more largely in the back half of the hoof and there is greater length of hoof in contact with the ground and greater expansion of the heels than in the natural hoof.

In the upright or stumpy hoof (fig. 5*c*) the foot axis is straight and the angle is wide. The hoof is relatively short from toe to heel, the weight falls farther forward, and there is less expansion of the heels than in the normal hoof.

Finally, there are wide hoofs and narrow hoofs, depending solely on race and breeding. The wide hoof is almost circular on the ground surface, the sole but little concave, the frog large, and the quality of the horn coarse. The narrow hoof has a strongly "cupped" sole, a

small frog, nearly perpendicular side walls, and fine-grained, tough horn.

Hind hoofs are influenced in shape by different directions of their pasterns much as front feet are. A hind hoof is not round at the toe as a front hoof is but is more pointed. Its greatest width is two-thirds of the way back from toe to heel, the sole is more concave, the heels relatively wider, and the toe about 10° steeper than are front hoofs.

EXAMINATION PRELIMINARY TO SHOEING

The object of the examination is to ascertain the direction and position of the legs, the shape, character, and quality of the hoofs, the form, length, position, and wear of the shoe, the number, distribution, and direction of the nails, the manner in which the hoof leaves the ground, its line of flight, the manner in which it is set to the ground, and all other peculiarities, so that at the next and subsequent shoeings proper allowances may be made and observed faults corrected. The animal, therefore, must be observed both at rest and in motion.

With the animal at rest, the observer should stand in front and note the slant of the long pasterns. Do they drop perpendicularly, or slant downward and outward (base-wide foot), or downward and inward (base-narrow foot)? Whatever be the direction to the long pastern, an imaginary line passing through its long axis, when prolonged to the ground, should apparently pass through the middle of the toe. But if such a line cuts through the inner toe the foot axis is not straight, as it should be, but is broken inward at the coronet, this is an indication that either the outer wall of the hoof is too long (high) or that the inner wall is too short (low). On the contrary, if the center line of the long pastern falls through the outer toe the foot axis is broken outward at the coronet, this is an indication that either the inner wall is too long or the outer wall too short.

The observer should now place himself at one side, 2 or 3 paces distant, in order to view the leg and hoof in profile. Note the size of the hoof in relation to the height and weight of the animal, and the obliquity of the hoof. Is the foot axis straight, that is, does the long pastern have the same slant as the toe, or does the toe of the hoof stand steeper than the long pastern (fig. 6c)? In the latter case the foot axis is broken forward at the coronet, an indication, usually, that the quarters are either too high or that the toe is too short.

If the long pastern stands steeper than the toe (fig. 6a) the foot axis is broken backward, in which case the toe is too long or the quarters are too low (short). In figures 6a and 6c the dotted lines passing from toe to quarters indicate the amount of horn that must be

removed in order to straighten the foot axis, as shown in figure 6*b*. Note also the length of the shoe.

Next, the feet should be raised and the examiner should note the outline of the foot, the conformation of the sole, form and quality of the frog, form of the shoe, wear of the shoe, and the number and distribution of the nails. Does the shoe fully cover the entire lower border of the wall, or is it too narrow, or fitted so full on the inside that it has given rise to interfering? Or has the shoe been nailed on crooked, or has it become loose and shifted? Is it too short, or so wide at the ends of the branches as not to support the buttresses of the hoof? Does the shoe conform with the normal shape of the hoof? Are the nails distributed so as to interfere as little as possible with the expansion of the quarters, are there too many nails or are they too

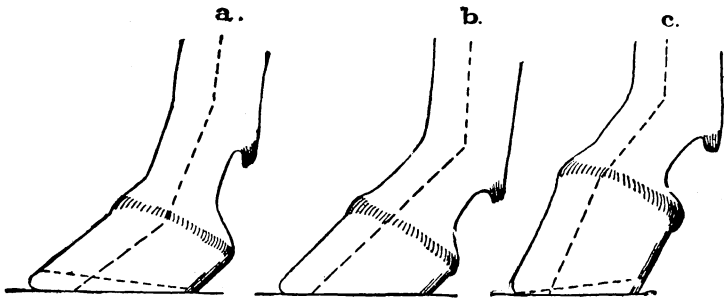


FIGURE 6.—*a*, Side view of foot with the foot axis broken backward as a result of too long a toe. The amount of horn to be removed from the toe in order to straighten the foot axis is denoted by a dotted line; *b*, side view of a properly balanced foot, with a straight foot axis of desirable slant; *c*, side view of stumpy foot with foot axis broken forward, as a result of overgrowth of the quarters. The amount of horn to be removed in order to straighten the foot axis is shown by a dotted line.

large, driven too shallow or too high? These are questions which the observer should ask himself.

Note carefully the wear of the old shoe. It furnishes evidence of the manner in which the hoof has been set to the ground since the shoe was nailed to it and gives valuable pointers in leveling the hoof. Wear is the effect of friction between the shoe and the ground at the moment of contact. Since the properly leveled hoof is set flat to the ground, the "grounding wear" of a shoe should be uniform at every point, though the toe will always show wear due to scouring at the moment of "breaking over." Everything that tends to lengthen the stride tends also to make the grounding wear more pronounced in the heels of the shoe, whereas all causes that shorten the stride—as stiffening of the legs through age, overwork, or disease—bring the grounding wear nearer the toe.

An exception should be noted, however, in founder, in which the grounding wear is most pronounced at the heels.

If one branch of the shoe is worn much thinner than the other, the thinner branch has either been set too near the middle line of the foot (fitted too close), where it has been bearing greater weight while rubbing against the ground, or, what is much more often the case, the section of wall above the thinner branch has been too long (too high), or the opposite section of wall has been too short (too low). One-sided wear, uneven setting down of the feet, and an unnatural course of the wall are often found together. How much an old shoe can tell us, if we take time and pains to decipher its scars!

The horse should next be observed at a walk and at a trot or pace, from the front, from behind, and from the side, and the breaking over, the carriage of the feet, and the manner of setting them to the ground carefully noted and remembered. A horse does not always move just as its standing position would seem to imply. Often there is so great a difference in the form and slant of two fore hoofs or two hind hoofs that there is doubt as to their normal shape. A few steps at a trot will usually solve the problem instantly by showing the line of flight of the hoofs and referring them to the regular, base-wide, or base-narrow form.

No man is competent either to shoe a horse or to direct the work till he has made the foregoing observations.

PREPARATION OF THE HOOF FOR THE SHOE

After raising the clinches of the nails with a rather dull clinch cutter (buffer) and drawing the nails one at a time, the old shoe is critically examined and laid aside. Remaining stubs of nails are then drawn or punched out and the hoof freed of dirt and partially detached horn. The farrier has now to dress the overgrown hoof to receive the new shoe; in other words, he has to form a base of support so inclined to the direction of the pasterns that in motion this surface shall be set flat upon the ground. He must not rob the hoof nor leave too much horn; either mistake may lead to injury. If he has made a careful preliminary examination he knows what part of the wall requires removal and what part must be left, for he already knows the direction of the foot axis and the wear of the old shoe and has made up his mind just where and how much horn must be removed to leave the hoof of proper length and the foot axis straight.

A greatly overgrown hoof may be quickly shortened with sharp nippers and the sole freed of semidetached flakes of horn. The concave sole of a thick-walled, strong hoof may be pared out around the point of the frog but not so much as to remove all evidences of exfoliation. The wall should be leveled with the rasp till its full thickness, the white line, and an eighth of an inch of the margin of the sole are in one horizontal plane, called the bearing surface of the hoof. The bars, if long,

may be shortened, but never pared on the side. The branches of the sole in the angle between the bars and the wall of the quarters should be left a little lower than the wall, so as not to be pressed upon by the inner web of the shoe. Corns, or bruises of the pododerm, are usually a result of leaving a thick mass of dry, unyielding horn at this point. The frog should not be touched further than to remove tags or layers that are so loose as to form no protection. A soft frog will shorten itself spontaneously by the exfoliation of superficial layers of horn, whereas if the frog is dry, hard, and too prominent it is better to soften it by applying moisture in some form and to allow it to wear away naturally than to pare it down. It is advantageous to have the frog project below the level of the wall an amount equal to the thickness of a plain shoe, though frogs of such size are rarely seen except in draft horses. The sharp lower border of the wall should be rounded with the rasp to prevent its being bent outward and broken away. Finally, the foot is set to the ground and again observed from all sides to make sure that the lines bounding the hoof correspond with the direction of the long pastern.

THE SHOE

The shoe is an artificial base of support, by no means ideal, because it interferes to a greater or less degree with the physiology of the foot, but indispensable except for horses at slow work on soft ground. Since a proper surface of support is of the greatest importance in preserving the health of the feet and legs, it is necessary to consider the various forms of shoes best adapted to the different forms of hoofs. Certain properties are common to all shoes and may be considered first. They are form, width, thickness, length, surfaces, borders, "fullering," nail holes, and clips.

Form.—Every shoe should have the form of the hoof for which it is intended, provided the hoof retains its proper shape; but for every hoof that has undergone change of form one must endeavor to give the shoe that form which the hoof originally possessed. Front shoes and hind shoes, rights and lefts, should be distinctly different and easily distinguishable.

Width.—All shoes should be wider at the toe than at the ends of the branches. The average width should be about double the thickness of the wall at the toe.

Thickness.—The thickness should be sufficient to make the shoe last about 4 weeks and should be uniform except in special cases.

Length.—This will depend on the obliquity of the hoof viewed in profile. The acute-angled hoof (fig. 5a) has long overhanging heels, and a considerable proportion of the weight borne by the leg falls in the posterior half of the hoof. For such a hoof the branches of the shoe should extend back of the buttresses to a distance nearly double the thickness of the shoe. For a hoof of the natural form (figs. 5b

and 8) the branches should project an amount equal to the thickness of the shoe. In a stumpy hoof (fig. 5c) the shoe need not project more than one-eighth of an inch. In all cases the shoe should cover the entire bearing surface of the wall.

Surfaces.—The surface that is turned toward the hoof is known as the upper, or hoof surface, of the shoe. That part of the hoof surface which is in actual contact with the horn is called the bearing surface of the shoe. The bearing surface should be perfectly horizontal from side to side and wide enough to support the full thickness of the wall, the white line, and about an eighth of an inch of the margin of the sole. The bearing surface should also be perfectly flat, except that it may be turned up at the toe ("rolling-motion" shoe, fig. 5, a, b, c). The surface between the bearing surface and the inner edge of the shoe is often beaten down or concaved to prevent pressure too far inward upon the sole. This concaving, or "seating," should be deeper or shallower as the horny sole is less or more concave. As a rule, strongly cupped soles require no concaving (hind hoofs, narrow fore hoofs).

Borders.—The entire outer border should be beveled under the foot. Such a shoe is not so readily loosened nor is it so likely to lead to interfering.

Fullering.—This is a groove in the ground surface of the shoe. It should pass through two-thirds of the thickness of the shoe, be clean, and of uniform width. It is of advantage in that it makes the shoe lighter in proportion to its width, and by making the ground surface somewhat rough, tends to prevent slipping.

Nail holes.—The shoe must be so punched that the nail holes will fall directly on the white line. They should be confined to the fore half of front shoes but may occupy the anterior two-thirds of hind shoes. For a medium-weight shoe three nail holes in each branch are sufficient, but for heavier shoes, especially those provided with long calks, eight holes are about right, though three on the inside and four on the outside may do.

Clips.—These are half-circular ears drawn up from the outer edge of the shoe either at the toe or opposite the side wall. The height of a clip should equal the thickness of the shoe, though they should be even higher on hind shoes and when a leather sole is interposed between the shoe and hoof. Clips secure the shoe against shifting. A side clip should always be drawn up on that branch of the shoe that first meets the ground in locomotion.

SPECIAL FEATURES AND FITTING THE SHOES

A shoe for a natural hoof (figs. 7 and 8) fits when its outer border follows the wall closely in the region of the nail holes and from the last nail to the end of the branch gradually projects beyond the surface

of the wall to an eighth of an inch and extends back of the buttresses an amount equal to the thickness of the shoe. The shoe must be straight, firm, air-tight, its nail holes directly over the white line, and its branches far enough from the branches of the frog to permit the passage of a foot pick. Branches of the shoe must be of equal length.

In fitting a shoe to a hoof of natural form, one follows the form of the hoof, but in base-wide and base-narrow hoofs, which are of irregular

form, one must pay attention not only to the form of the hoof but also to the direction of the pasterns and the consequent distribution of weight in the hoof, because where the most weight falls the surface of support of the foot must be widened, and where the least weight falls (opposite side of the hoof) the surface of support should be narrowed. In this way the improper distribution of weight within the hoof is evenly distributed over the surface of support.

A shoe for a base-wide hoof should be fitted full on the inner side of the foot and close on the outer side, because the inner side bears the most weight. The nails in the outer branch are placed well back, but in the inner branch are crowded forward toward the toe.

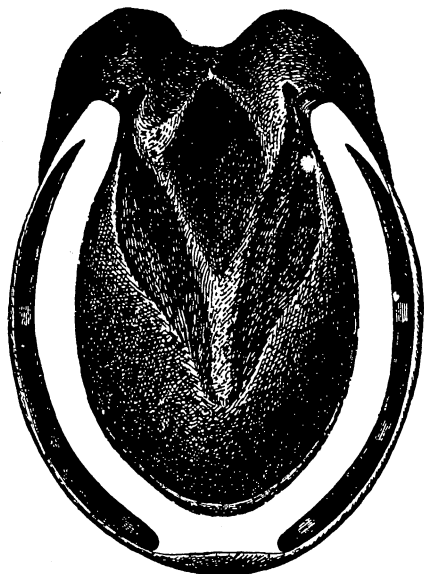


FIGURE 7.—Left fore hoof of natural form, shod with a plain fullered shoe. Note the distribution of the nails, length of the fuller (crease), and the closeness of the ends of the shoe to the branches of the frog.

A shoe for a base-narrow hoof should be just the reverse of the preceding. The outer branch should be somewhat longer than the inner.

A shoe for an acute-angled hoof should be long in the branches, because most of the weight falls on the posterior half of the foot. The support in front should be diminished either by turning the shoe up at the toe or by beveling it under the toe (fig. 5a).

A shoe for a stumpy hoof should be short in the branches and for pronounced cases should increase the support of the toe, where the most of the weight falls, by being beveled downward and forward.

In many cases, especially in draft horses, where the hoofs stand very close together, the coronet of the outer quarter stands out beyond the lower border of the quarter. In such cases the outer branch of the shoe from the last nail back must be fitted so full that

an imaginary perpendicular dropped from the coronet will just meet the outer border of the shoe. The inner branch, on the other hand, must be fitted as close as possible. The principal thought should be to set the new shoe farther toward the more strongly worn side. Such a practice will render unnecessary the widespread and popular fad of giving the outer quarter and heel calk of hind shoes an extreme outward bend. Care should be taken, however, that in fitting the shoe full at the quarter the bearing surface of the hoof at the quarter is not left unsupported or incompletely covered, to be pinched and squeezed inward against the frog. This will be obviated by making the outer branch of the shoe sufficiently wide and punching it so coarse that the nails will fall upon the white line.

Hot fitting.—Few farriers have either the time or the skill necessary to adjust a cold shoe to the hoof so that it will fit, as we say, airtight.

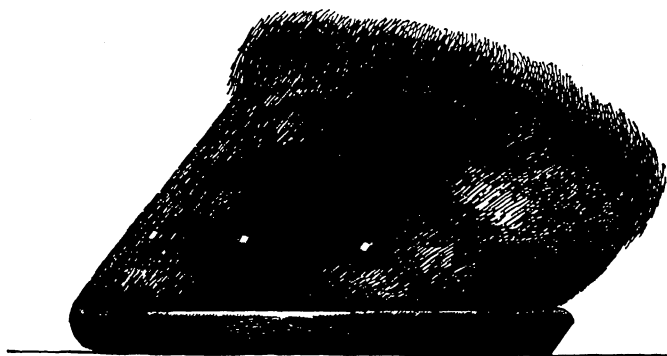


FIGURE 8.—Side view of hoof and shoe shown in figure 7. Note the straight toe, weak ring formation running parallel to the coronet, clinches low down and on a level, length of the shoe, and the under bevel at the toe and heel.

Though the opponents of hot fitting draw a lurid picture of the direful consequences of applying a hot shoe to the hoof, it is only the abuse of the practice that is to be condemned. If a heavy shoe at a yellow heat be held tightly pressed against a hoof that has been pared too thin, till it embeds itself, serious damage may be done. But a shoe at a dark heat may be pressed against a properly dressed hoof long enough to scorch, and thus indicate to the farrier the portions of horn that should be lowered without appreciable injury to the hoof and to the ultimate benefit of the animal.

Nailing.—The horse owner should insist on the nails being driven low. They should pierce the wall not more than $1\frac{1}{8}$ inches above the shoe. A nail penetrating the white line and emerging low on the wall destroys the least possible amount of horn, has a wide and strong clinch rather than a narrow one, which would be formed near the point of the nail, and, furthermore, has the strongest possible hold on the wall, because its clinch is pulling more nearly at a right angle to the grain

(horn tubes) of the wall than if driven high. Finally, do not allow the rasp to touch the wall above the clinches.

THE BAR SHOE

The bar shoe (fig. 9) has a variety of uses. It enables one to give the frog pressure, to restore it to its original state of activity and development when, because of disuse, it has become atrophied. It gives the hoof an increased surface of support and enables the

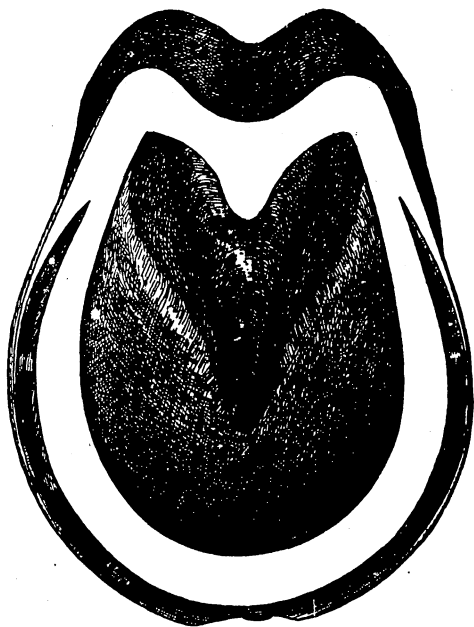


FIGURE 9.—An acute-angled left fore hoof shod with a bar shoe. Note the width and position of the bar and the fact that the nails are placed well toward the toe, so as not to interfere with the expansion of the quarters.

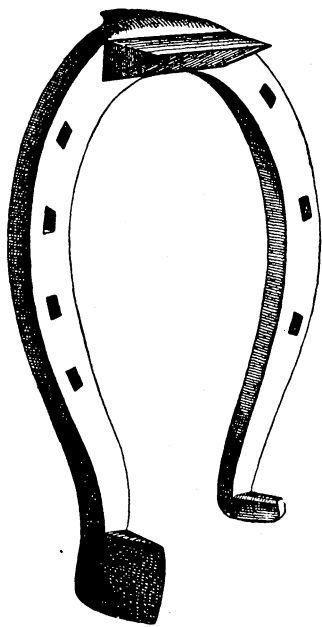


FIGURE 10.—A fairly formed right fore ice shoe. The toe and outer-heel calks cut at right angles, and the inner-heel calk is slender and blunt. The back surface of the toe calk should be perpendicular.

farrier to relieve one or both quarters of undue pressure that may have induced inflammation and soreness. The bar of the shoe should equal the average width of the remainder of the shoe and should press but lightly on the branches of the frog. The addition of a leather sole with tar and oakum sole packing allows the distribution of the weight of the body over the entire ground surface of the hoof.

THE RUBBER PAD

Various forms of rubber pads, rubber shoes, rope shoes, fiber shoes, and other contrivances to diminish shock and prevent slipping on the hard and slippery pavements of large cities are in use in different parts of the world. In Germany the rope shoe (a malleable-iron shoe

with a groove in its ground surface in which lies a piece of tarred rope) is extensively used with gratifying results. It is cheap, durable, easily applied, and effective.

In the large cities of England and the United States rubber pads are extensively used. They are rather expensive but are efficient in preventing slipping on pavements, though not so effective on ice. Figure 11 is an illustration of one of the best of many rubber pads. The rubber is stitched and cemented to a leather sole and is secured by the nails of a three-quarter shoe. Such a pad will usually last as long as two shoes. They may be used continuously, not only without injury to the hoof, but to its great benefit. The

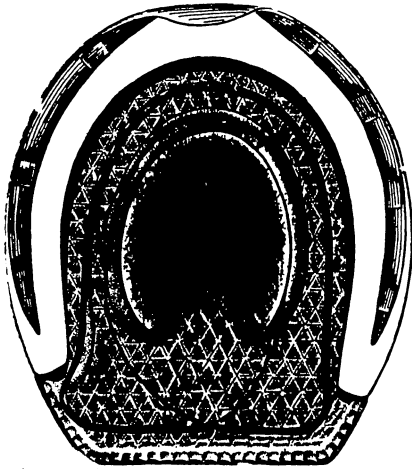


FIGURE 11.—Left fore hoof of regular form shod with a rubber pad and "three-quarter" shoe. (Ground surface.)

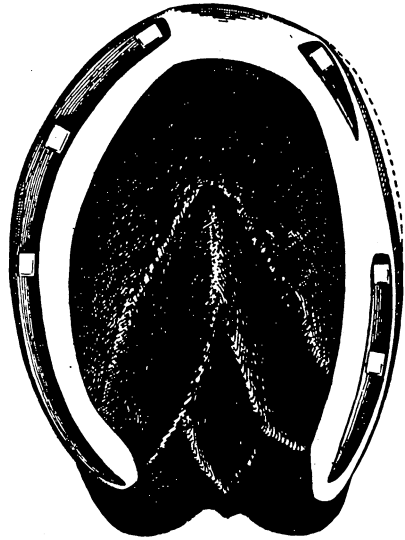


FIGURE 12.—A narrow right fore hoof of the base-wide (toe-wide) standing position, shod with a plain "dropped-crease" shoe to prevent the toe cutting (interfering). The dotted line at the inner toe indicates the edge of the wall which was rasped away in order to narrow the hoof along the striking section. Note the inward bevel of the shoe at this point, the dropped crease, the distribution of the nails, the long, full, inner branch, and the short, close, outer branch.

belief, unsupported by evidence, that rubber pads "draw the feet" keeps many from using them. A human foot encased in a rubber boot may eventually be blistered by the sweat poured upon the surface of the skin and held there by the impervious rubber till decomposition takes place with the formation of irritating fatty acids, but there is no basis for an analogy in the hoof of a horse.

OTHER SPECIAL FORMS

Some drawings, designed to illustrate shoeing in connection with "interfering" and "forging," and other special conditions, are shown in figures 13 to 18.

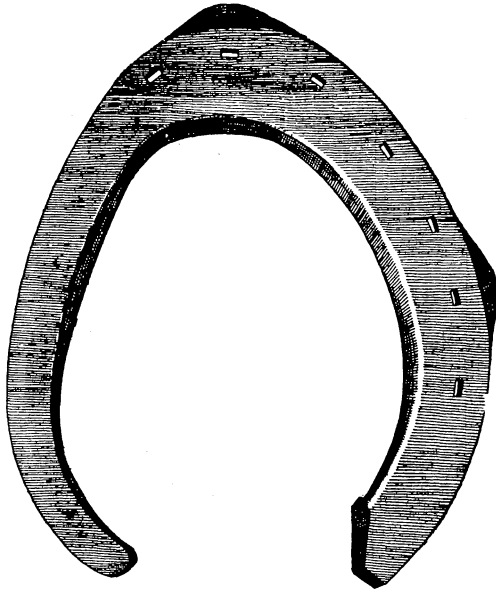


FIGURE 13.—Hoof surface of a right hind shoe to prevent interfering. The inner branch has no nail holes and is fitted and beveled under the hoof. Note the number and position of the nail holes, the clip on the outer side wall, and the narrowness and bend of the inner branch.

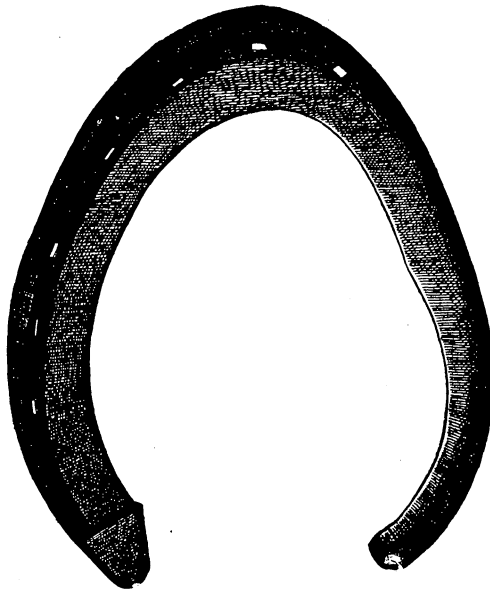


FIGURE 14.—Ground surface of shoe shown in the previous figure. The inner, nailless branch has the thickness of the outer branch plus its calk, so that the inner and outer quarters of the hoof are equidistant from the ground.

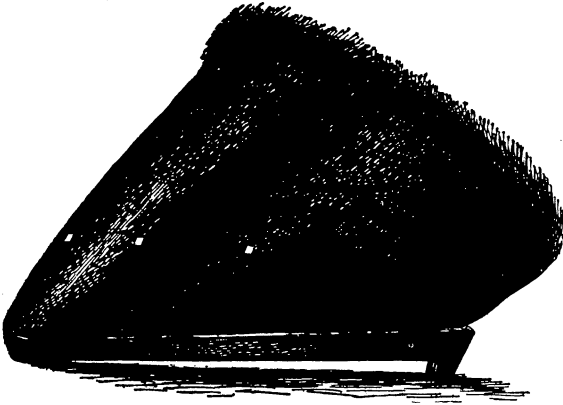


FIGURE 15.—Side view of a fore hoof shod so as to quicken the "breaking over" (quicken the action) in a "forger." Note the short shoe, heel calks inclined forward, and the rolled toe.

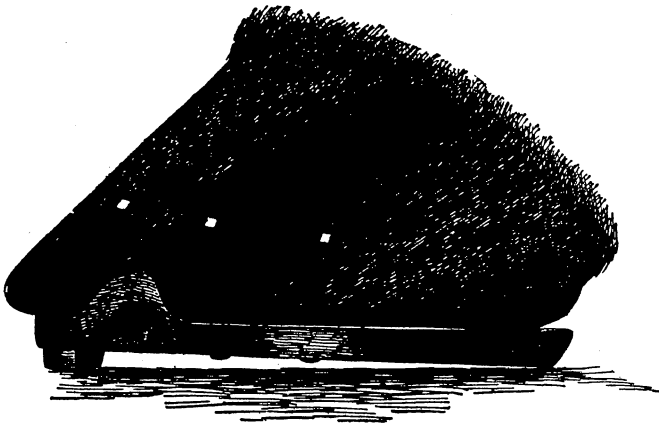


FIGURE 16.—Side view of a short-toed hind hoof of a forger, shod to slow the action and to prevent injury to the fore heels by the toe of the hind shoe. Note the elevation of the short toe by means of a toe calk and the projection of the toe beyond the shoe. When such a hoof has grown more toe, the toe calk can be dispensed with and the shoe set farther forward.

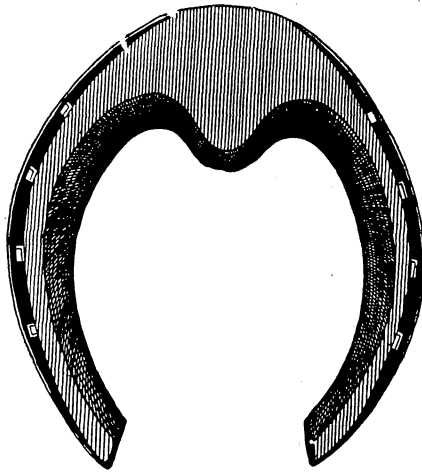


FIGURE 17.—A toe-weight shoe to increase the length of stride of forefeet. The nails are placed too far back, and the shoe has no characteristic form but the weight is properly placed.

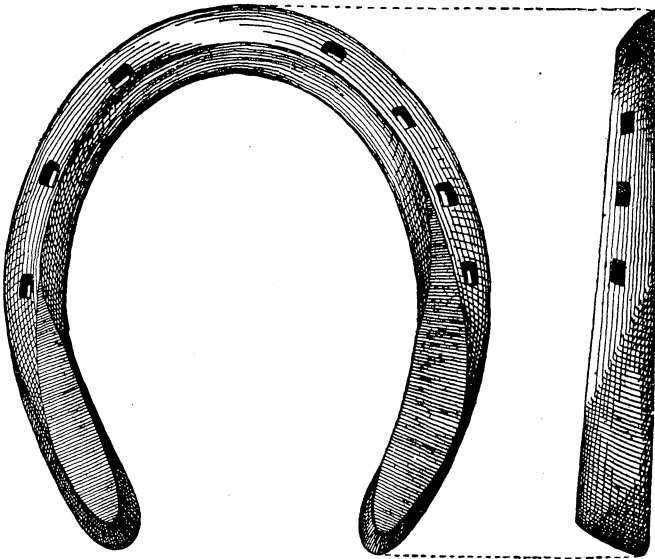


FIGURE 18.—Most common form of punched heel-weight shoe to induce high action in forefeet. The profile of the shoe shows a "roll" at the toe and "swelled" heels. The weight is well placed, but "rolling" the toe and raising the heels lower action. The shoe would be much more effective if of uniform thickness and with no roll at the toe.

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